A Housing Energy Management Program Report

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Ontario

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ENERGY CONSERVATION
BUILDING OPERATIONS DEMONSTRATION
FOR
FORTY HIGH-,MEDIUM- AND LOW-RISE MULTIPLE-UNIT
RESIDENTIAL BUILDINGS

Project Undertaken Jointly by the
Ontario Ministries of Municipal Affairs & Housing and
Energy under the Housing Energy Management Program
(HEMP)

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ENERGY CONSERVATION

BUILDING OPERATIONS DEMONSTRATION PROJECT

FOR

FORTY HIGH-, MEDIUM- AND LOW-RISE MULTIPLE-UNIT RESIDENTIAL

BUILDINGS

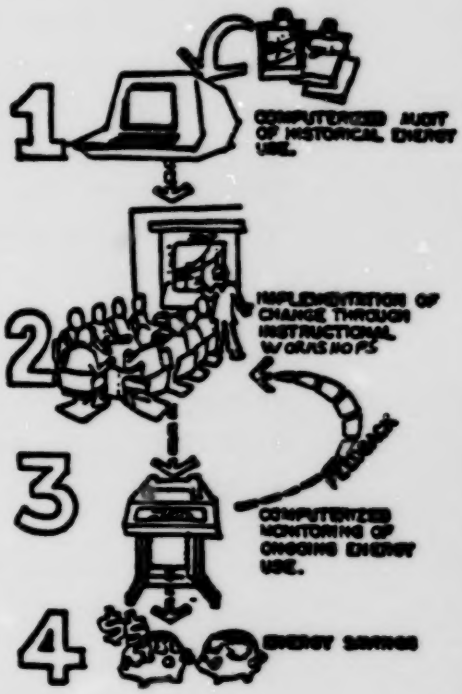
PART 1

EXECUTIVE SUMMARY

1. INTRODUCTION

In October 1981, groups of apartment building owners and managers attended a briefing session to learn about an upcoming energy management demonstration project. The purpose of the project was to gauge the effectiveness of instructional workshops in conjunction with an audit of previous years' energy use and monitoring of ongoing energy use.

The project was to be managed by the Ontario Ministry of Municipal Affairs and Housing, and funded by the Ministry of Energy under the Housing Energy Management Program (HEMP).



After the briefing session, forty buildings were selected to participate in the project. Selection was on a first come, first served basis. Two groups were created:

1. twenty-five medium- and low-rise, fuel heated buildings
2 fifteen medium- and high-rise, electrically heated buildings.

Of the fifteen electrically heated buildings, eight have been designated "hybrid" because they use some fuel for heating and for supplementary systems, such as domestic hot water heating.

The Ministry paid the consultant's fees. Building owners were required to supply suitable personnel, to ensure that recommended work was carried out, and to pay the costs of changes made to building systems. This obligation was limited to a maximum of $5,000.

Groups of owners, managers and superintendents, representing the forty buildings, assembled for the first workshops in November 1981. Between then and June 1982, they attended six workshops in eight groups. Each group was made up of eight to ten people representing four to six buildings. A follow-up session was also held in January and February of 1983. At the workshops, they continued the learning process, and reviewed successes and difficulties with other participants and the consultant.

The energy management measures to be implemented in each building were selected by the participants with assistance from the computerized energy audit. The audit uses fuel and electricity bills from a building to produce a record of energy performance, broken down into eight components (six for all-electric buildings). This division into components points out the areas where action will provide the best savings.

Effectiveness of changes made was tracked by computerized monitoring of ongoing monthly energy use. The monitor shows actual energy use each month, compared with the equivalent month of the base year, and normalized for weather and billing period differences.

This report details the outcome of the two years of the project and analyses trends established over the two years of energy management.

2. RESULTS OF FIRST YEAR OF PROJECT

The first year of the project covered the period from September 1981 to August 1982. This 12 month period included three months before the workshops began, six months during which changes were being made, and three months following completion of the workshops.

The first year energy savings achieved by the fuel heated buildings in this project were slightly lower than in an earlier study(1) of twenty fuel heated, high-rise, multiple-unit residential buildings.

The total first year savings for the twenty larger buildings were $81,110 (1981 dollars), averaging 8 percent. The total first year expenditure by owners of those buildings was $49,030.

For the twenty-five smaller fuel heated buildings in this study, the total first year savings were $63,000, averaging 6 percent. The total cost to building owners was $41,600.

Overall percentage energy savings for the all-electric buildings in this project were substantially less than for the fuel-heated buildings. The absence of boiler and heating system inefficiencies, found in most gas or oil heated buildings, is believed to substantially reduce the potential for energy savings in the all-electric building. On the other hand, the higher unit cost of electricity, and the opportunity to reduce monthly electrical peak demand charges by deferring use of electrical loads, can make the financial return on energy management investment in the all-electric building very worthwhile. Savings for the six all-electric buildings averaged 1.5 percent, worth $26,900. The total amount spent was $30,000.

Discounting the influence of two buildings which had large energy cost increases associated with occupancy increases, results for the hybrid-heated buildings in terms of energy and dollar savings, came, as expected, between those achieved in their fuel heated and all-electric counterparts. Energy savings for the six hybrid buildings considered, averaged 4 percent, worth $37,000. The total expenditure in these buildings was $8,500.

Poor attendance and lack of continuity of representation at the workshops were identified as contributing factors to poor results in the earlier study. These problems were not as pronounced in this project. Attendance and effort have generally been very good. Where savings are not realized, other factors are involved. Identified reasons include increased occupancy, technical problems which have taken time to resolve, and lack of money to implement necessary changes.

During the earlier twenty buildings project, two buildings left after the first workshop. One was sold, and the other changed management company. During this project, one building, 263 Ontario Street, Milton, left after its owner, the Coventry Group, went into receivership. A condominium building, 8111 Yonge Street, withdrew later in the program.

Little correlation was found between first year savings in individual fuel-heated buildings and previous energy use levels. For example, 1274 York Mills, 1265 Sixth Line and 222 Jackson were among the lowest energy users in the group, but achieved some of the greatest savings. Among the all-electric and hybrid-heated buildings a trend towards higher first year savings for higher base year consumption was observed.

Net energy savings in the first year were achieved in:

- twenty of the twenty-five fuel heated buildings
- four of the six all-electric buildings
- six of the nine hybrid-heated buildings.

Relationships between first year savings and heating system, overall ownership types, workshop attendance and base year energy use are summarized in Table 1.1.

Buildings which experienced problems affecting their savings are identified in Table 1.2.

TABLE 1.1

FACTORS AFFECTING FIRST YEAR ENERGY SAVINGS

	PERCENT ENERGY SAVINGS	
	Range	Average
Heating Type		
Fuel Heated Buildings	- 5 to 29	5.8
All-Electric Buildings	- 4 to 4	1.5
Hybrid-heated Buildings	-15 to 9	4.0
Ownership Type		
Condominiums and Co-ops	-15 to 29	5.5
Non-Profit	0.5 to 9	4.9
Rental	- 5 to 19	4.7
Attendance		
7 Workshops (6 + follow up session)	- 1 to 19	5.4
6 Workshops	- 15 to 16	1.3
5 Workshops	- 4 to 9	2.0
3 and 4 Workshops	6.5 to 29	14.1

Base Year Energy Use (ekWh/sq.ft./yr)			
Range	Average		
15-25	20.7	-15 to 11	.8
26-35	31.4	- 5 to 16	6.9
36-45	37.4	0 to 19	4.4
46-72	55.4	- 1 to 29	8.3

TABLE 1.2

PROBLEMS RELATED TO SAVINGS REALIZATION

	BUILDING	COMMENTS
Occupancy Change	Palm Beach	Low occupancy due to ongoing building renovation during first year
	3025 Credit Woodlands	Occupancy increase. This resulted in a deficiency in domestic hot water capacity and subsequent DHW boiler addition.
	284 & 300 Mill Road	Occupancy increase.
Technical Problems	345 Sentinel	Outdoor reset controller, installed prior to program was incorrect model for application. Workshops identified and helped to resolve this problem.
	1860 Lawrence Ave.E.	Although a new building, there were two major problems which took time to identify and correct: 1 - malfunctioning boiler controls; 2 - basement air conditioning system required summer boiler operation.

TABLE 1.2 (contd)

PROBLEMS RELATED TO SAVINGS REALIZATION

	BUILDING	COMMENTS
	2163 Queen Street	A major part of the savings in this co-op was realized by ongoing building upgrading concurrent with the program.
	175 Cummer	Inoperative existing equipment was identified and repaired, resulting initially in reduced billing demand, but consumption increase in second year.
	3341 Finch	Demand savings mostly resulted from Ontario Hydro installation of load management equipment.
Lack of Money	330 Gerrard	The budget for this public housing building was completely absorbed by refurbishing DHW risers, leaving no funds for energy management.
	105 Winlaine	Cash flow problems in this private rental building delayed implementation of even low cost actions.

3. DESCRIPTION OF SECOND YEAR AND OVERALL RESULTS OF PROJECT

The second year of the project was from September 1982 to August 1983. Monthly monitoring of ongoing energy use continued during that period to identify savings and setbacks. In addition, a follow up session was held for each group of buildings during January and February of 1983. The energy monitor reports were studied and outstanding implementation questions were resolved. With only one workshop for each group in the second year, consultant costs were lower.

Second year overall savings were 8 percent, double the first year savings. Some buildings continued energy management actions into the second year, thus adding to the savings. However, the major contributions to higher savings in 1982/83 came from changes being in effect for the whole year and from enthusiasm and dedication of the representatives of many of the buildings.

Energy use levels before the project, and for each of the two years of the project are shown for fuel, hybrid and electrically heated buildings in Figures 1.1, 1.2 and 1.3, respectively.

3.1 Categorization of Buildings According to Savings

Comparative analysis of savings in the buildings revealed four patterns of change in energy use. Each building in Figures 1.1 to 1.3 is assigned a category, according to its change in energy use over the two years of the project.

CATEGORY I — Energy cost savings achieved in first year were increased significantly in second year.

CATEGORY II — A marked reversal in energy cost savings between year one and year two.

CATEGORY III — No significant change in energy use during the project.

FIG 1.1A : ENERGY USE SUMMARY FUEL HEATED

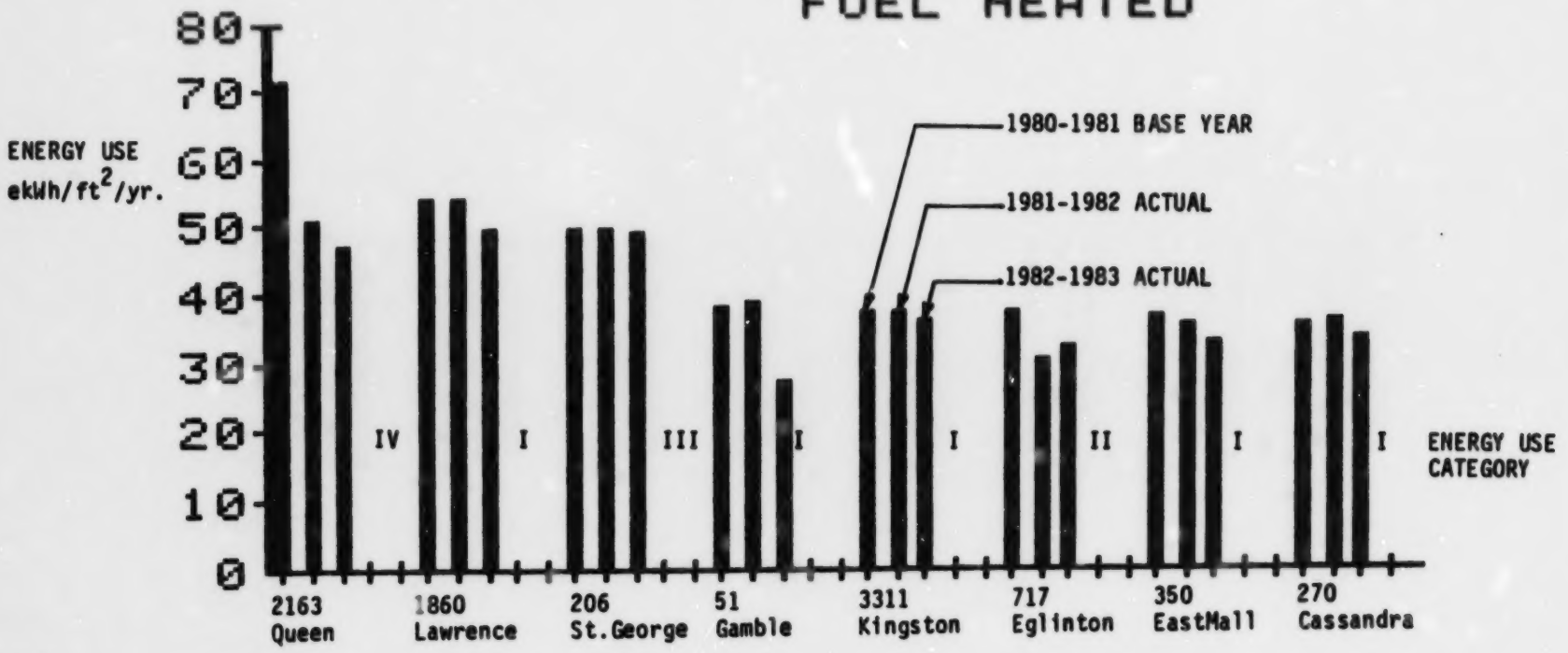


FIG 1.1B : ENERGY USE SUMMARY FUEL HEATED

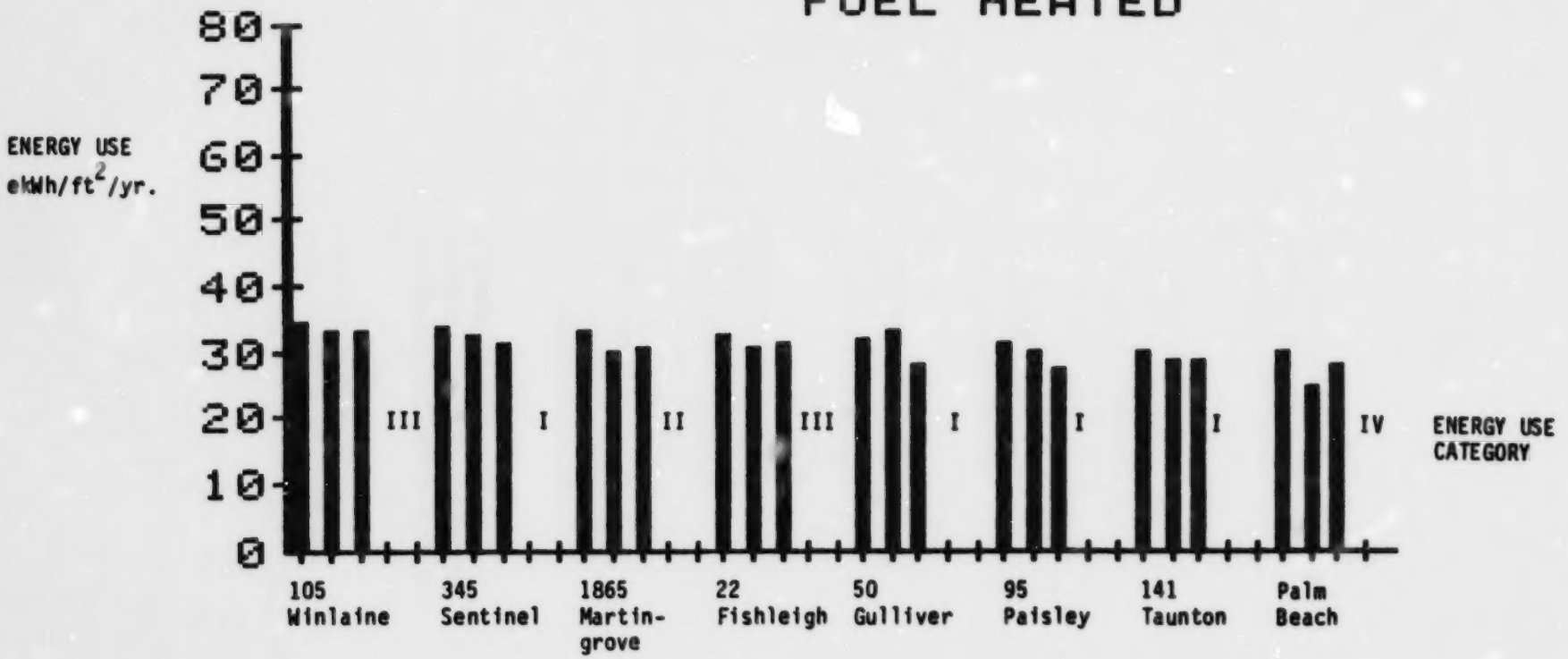


FIG 1.1C : ENERGY USE SUMMARY FUEL HEATED

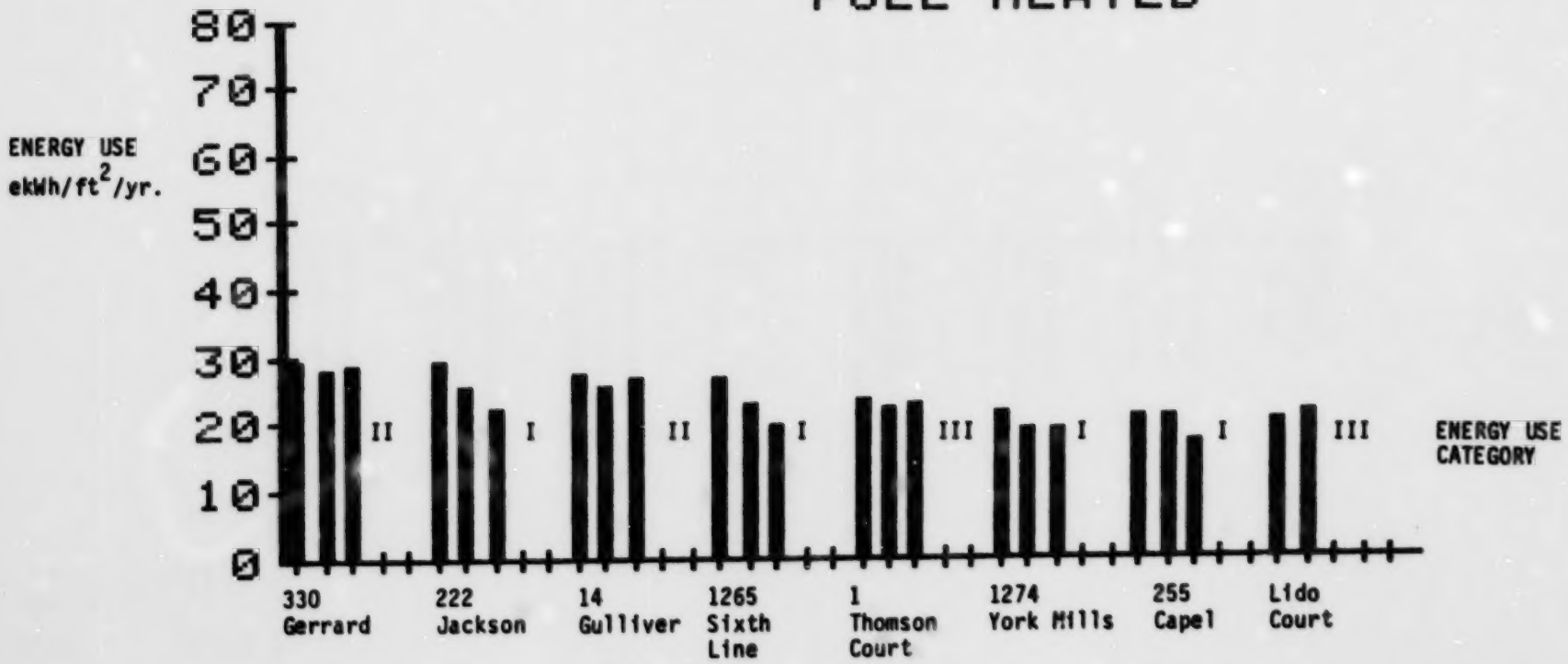


FIG 1.2 : ENERGY USE SUMMARY HYBRID

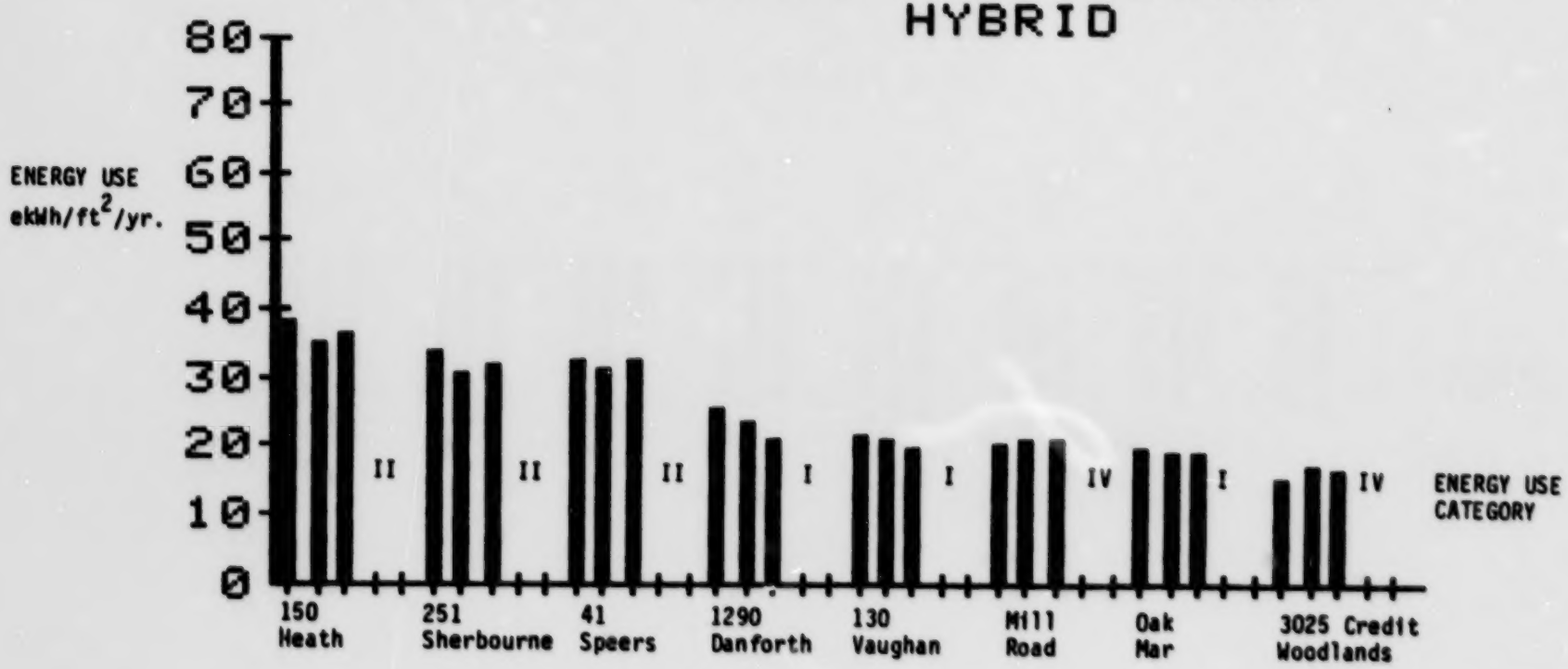
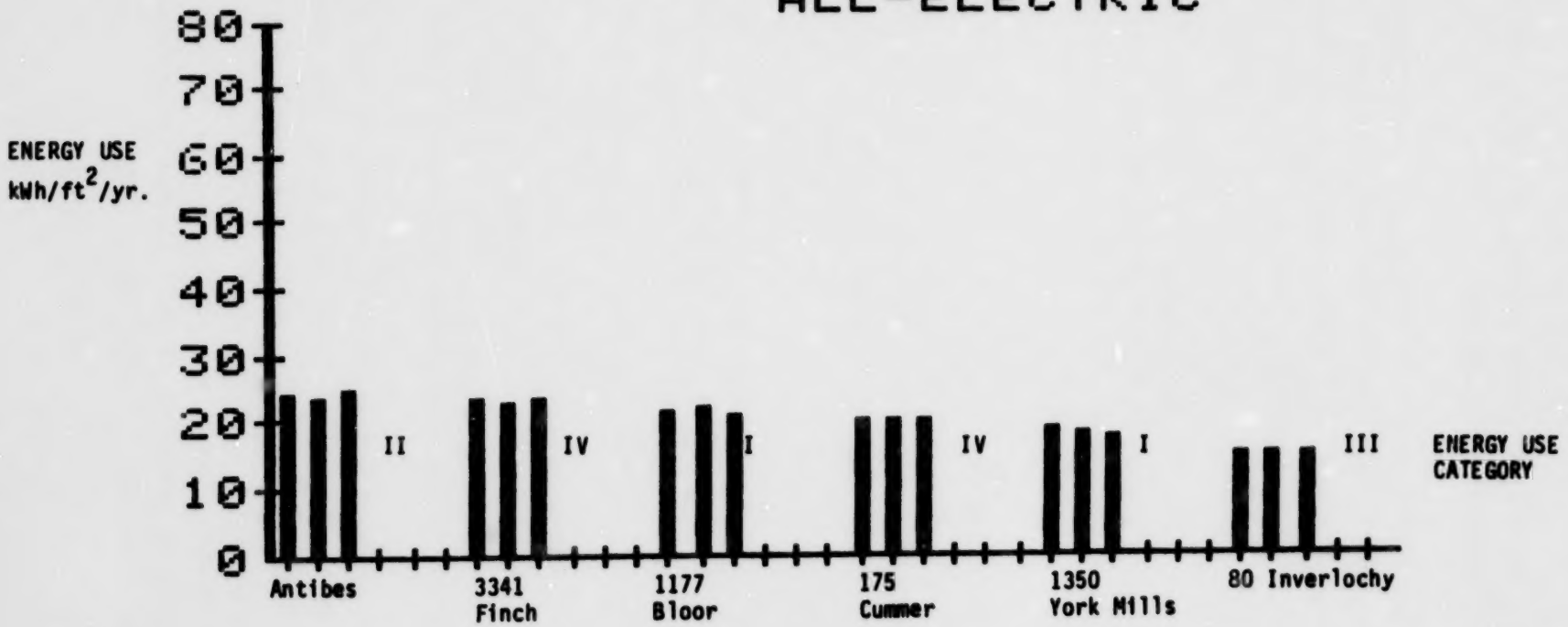


FIG 1.3 : ENERGY USE SUMMARY ALL-ELECTRIC



BUILDING

CATEGORY IV Factors not related to project affected pattern of change of energy use.

Unlike the earlier study, the category to which each building was assigned did not relate strongly to base year energy use or to workshop attendance. Categorization depended more on other factors such as occupancy changes or major renovations to buildings.

Table 1.3 shows dollar and percentage energy cost savings for the buildings grouped in the four categories. Total expenditures are also given in this table. Savings made in each category are summarized below.

CATEGORY I (First year savings improved in second year).

There are eighteen buildings in this category. Thirteen of the buildings are fuel heated, three are hybrids and two all-electric.

Initial energy use for this group ranged from 18.93 ekWhr/sq.ft./yr. for 1350 York Mills, an all-electric condominium to 54.23 ekWhr/sq.ft./yr. for 1860 Lawrence, a gas heated seniors' building.

Average energy cost savings of 4 percent in the first year for this category were worth $38,304. Average savings in the second year increased to 18 percent, worth $138,465. The total expenditure for buildings in this group was $71,840.

The largest investment was at 1350/1360 York Mills ($23,000) which achieved the largest savings: $30,933 over two years. Most of this large expenditure was made in the second year, on high efficiency outside lighting and on enclosing the heated ramp. The highest second year saving was at 51 Gamble ($22,597) following conversion of the oil fired boiler to gas and upgrading of controls, in the summer of 1982.

TABLE 1.3

COSTS AND SAVINGS FOR THE FORTY BUILDING DEMONSTRATION PROJECT

(Buildings presented in order of second year savings)

BUILDING	HEATING	TOTAL COST	TOTAL DOLLAR SAVINGS FIRST YEAR		SECOND YEAR	
		$	$	%	$	%
CATEGORY I						
51 GAMBLE	FUEL	10,000	-892	-1	22,597	50
1350 YORK MILLS	ELECTRIC	23,000	10,127	3	20,806	7
1265 SIXTH LINE	FUEL	3,900	9,331	15	17,313	24
222 JACKSON	FUEL	6,000	5,783	9	14,968	20
1860 LAWRENCE	FUEL	1,730	1,508	1	12,240	8
1290 DANFORTH	HYBRID	900	2,679	4	6,511	10
350 EAST MALL	FUEL	3,720	2,672	5	5,908	9
345 SENTINEL	FUEL	2,700	2,574	5	5,009	9
3311 KINGSTON RD	FUEL	7,580	1,208	1	4,694	4
95 PAISLEY	FUEL	1,430	1,781	5	4,080	11
1274 YORK MILLS	FUEL	0	2,853	10	3,842	12
255 CAPEL	FUEL	300	-338	0	3,575	14
50 GULLIVER	FUEL	2,100	Monitor year incomplete		3,453	11
130 VAUGHAN	HYBRID	700	1,810	5	2,995	8
141 TAUNTON	FUEL	950	2,699	8	2,881	7
1177 BLOOR	ELECTRIC	550	-7,051	-5	2,755	2
OAK MAR	HYBRID	4,900	1,715	3	2,527	4
270 CASSANDRA	FUEL	1,380	-155	0	2,311	4
SUB TOTAL		71,840	38,304		138,465	
CATEGORY II						
150 HEATH	HYBRID	1,380	10,158	10	6,989	7
717 EGLINTON	FUEL	1,140	5,327	15	4,582	12
1865 MARTINGROVE	FUEL	270	5,213	8	3,905	6
251 SHERBOURNE	HYBRID	300	6,931	5	2,011	1
14 GULLIVER	FUEL	900	2,090	7	1,332	4

TABLE 1.3 (contd)

BUILDING	HEATING	TOTAL COST $	TOTAL DOLLAR SAVINGS FIRST YEAR $	%	SECOND YEAR $	%
CATEGORY II (contd)						
330 GERRARD	FUEL	360	1,788	4	799	2
41 SPEERS	HYBRID	300	1,888	2	-963	0
115-135 ANTIBES	ELECTRIC	0	10,258	4	-1,307	1
SUB TOTAL		4,650	43,653		17,348	
CATEGORY III						
80 INVERLOCHY	ELECTRIC	225	-11	0	1,850	2
206 ST.GEORGE	FUEL	2,025	532	1	929	2
1 THOMSON CT.	FUEL	300	258	1	718	1
105 WINLAINE	FUEL	4,800	753	3	590	2
22 FISHLEIGH	FUEL	0	1,006	4	350	1
LIDO COURT	FUEL	0	-135		Data unavailable	
SUB TOTAL		7,350	2,403		4,437	
CATEGORY IV						
PALM BEACH	FUEL	N/A	11,781	19	6,687	10
2163 QUEEN	FUEL	N/A	5,387	26	6,452	29
3341 FINCH	ELECTRIC	1,200	3,643	3	4,488	3
175 CUMMER	ELECTRIC	5,400	3,987	4	-1,673	-1
MILL ROAD	HYBRID	15,000	-9,844	-1	-8,342	-1
3025 CREDIT WOODLANDS	HYBRID	700	-21,175	-12	-12,484	-6
SUB TOTAL		22,300	-6,221		-4,872	

TABLE 1.3 (contd)

BUILDING	HEATING	TOTAL COST	TOTAL DOLLAR SAVINGS FIRST YEAR		SECOND YEAR	
		$	$	%	$	%
COSTS FOR WORKSHOPS COMPUTERIZED AUDITS + MONITORING OF ENERGY USE FOR 1981/82		98,000				
FOLLOW UP WORKSHOP + MONITORING COSTS FOR 1982/83		42,560				
TOTALS		236,700	78,139		155,378	

This conversion realized a 29 percent energy saving as well as the cost differential of gas relative to oil. All of the buildings in this category recovered the total cost of changes before the end of the project. The average payback, based on second year savings, was six months.

CATEGORY II (Marked reversal in savings from year 1 to year 2)

There are eight buildings in this category: four fuel heated, three hybrid and one all-electric. All made savings in the first year - an average of 7 percent, worth $43,653. In the second year, 4 percent average savings were worth $17,348. Two of the buildings experienced energy cost increases relative to the base year. These buildings were 41 Speers, which underwent a management change, and 115-135 Antibes, where an unexplained setback occurred. Similar factors affected the savings of the other six buildings in this category. 150 Heath, which dropped from 10 to 7 percent savings also had a management change. Availability of funds was a problem for two buildings in this category: 330 Gerrard, a public housing building and 251 Sherbourne, a non-profit building. This category spent the least money on changes; an average of $581 per building.

CATEGORY III (No significant change in energy use).

Six buildings are in this category: five fuel heated and one all-electric. Among them is the second lowest initial energy user of the thirty-eight buildings, 80 Inverlochy. The base year total energy use of 14.91 ekWhr./sq.ft./year at this all-electric condominium increased by a small amount in the first year. Dollar savings were made in the second year due to demand reduction.

Two of the buildings, 22 Fishleigh and Lido Court saw no energy use changes during the project. The largest expenditure was made at 105 Winlaine ($4,800). This building initially had cash flow problems. The major part of this

investment was made in the summer of 1982, on domestic hot water pipe insulation. Savings from the actions taken were cancelled by increased use of electric heat in the suites.

The total cost savings in the first and second year for this category, were $2,403 and $4,437 respectively.

CATEGORY IV (Factors unrelated to project affected energy savings).

There are six buildings in this category: two are fuel heated, two are hybrid and two are all-electric. Savings (or increases) experienced at these buildings were largely unrelated to changes made during the project. In the first year there was a net increase in energy cost of $6,221 due mainly to the 12 percent increase at 3025 Credit Woodlands, a large, electrically heated condominium. In the second year there was a net dollar increase of $4,872. The total expenditure for the category was $22,300. Of this, $15,000 was spent by the Mill Road buildings. The benefits of this investment are hidden by increased energy use due to a 25 percent occupancy increase over 1980/81.

Occupancy increases were also responsible for the large increase in energy cost at 3025 Credit Woodlands. The increased energy use at this building was reduced to about one-half in the second year of the program due to concerted efforts of manager and dedicated board members. The increases at these two large buildings brought down the total dollar savings for this category significantly.

A second year energy cost increase was also experienced at 175 Cummer. Non-functioning equipment in this building was repaired and brought back into service during the project, resulting in increased energy use.

Expenditures to be made at Palm Beach and 2163 Queen were already committed. The workshops served to guide rehabilitation work to maximize energy savings. Both buildings were undergoing major changes during the project.

At Palm Beach, occupancy fluctuated in the eight buildings in the complex, as they underwent renovation. This resulted in 19 percent savings in the first year followed by 10 percent in the second. Renovations also contributed to the large savings (26 percent in first year and 29 percent in second) at 2163 Queen Street. Significant occupancy changes during renovation were not reported for this building. These buildings provide excellent examples of combined rehabilitation and energy conservation.

3.2 Overall Performance By Heating System Type

The above categories included all three types of buildings: fuel heated, hybrid and all-electric. Heating system type has an effect on the opportunities for energy conservation and thus the savings potential of each building.

The fuel heated buildings achieved average first year energy cost savings of 6 percent, worth $63,024. Second year savings averaged 10.5 percent, worth $129,215.

Excluding 3025 Credit Woodlands and 284 & 300 Mill Road, first year dollar savings averaged 4 percent for the hybrid buildings, worth $36,857. Second year savings were worth $20,070.

For the all-electric buildings, first year average savings were 1.5 percent, worth $20,953. Second year average savings were 2 percent, worth $26,919.

4. CONCLUSIONS

1. The project produced $233,520 in savings over the two year period. The total cost of changes made and of consulting services was recovered within the two years of the project.

2. The largest costs involved in this project were the consulting fees for workshops and the contractors' charges for work performed. Most of the savings achieved are expected to continue, with the only ongoing cost being monitoring of utility consumption.

3. Representatives from 80 percent of the buildings acquired the knowledge and had the commitment to achieve savings in the first year of the project and to improve these savings in the second year.

4. Success was related to continuity of management, incentive, and availability of funds. In situations of rent review or public funding, the incentive to save operating costs was lower. Despite the original commitment to implement necessary changes, at least one rental building had to delay expenditures because of cash flow problems. These problems of low cash flow and lack of incentive were the factors behind a relationship between ownership type and savings achieved. Condominiums and co-ops achieved the highest average savings; non-profit housing the lowest.

   Other factors such as technical problems, occupancy changes and changes made to the building which were not related to the project, had a major effect on the savings achieved.

5. Initial energy use does not necessarily determine potential savings. Several of the highest energy savers were also among the lowest initial energy users.

6. Potential savings are related to the type of heating system in the building. Comparison of results between fuel heated, hybrid and all-electric buildings from categories I to III, may be summarized as follows:

	Fuel Heated	Hybrid	All-Electric
Number of buildings in project, excluding Category IV	22	6	4
Number of successful* buildings	12	3	2
Initial average energy use (ekWhr./sq.ft./year)	33.84	25.74	20.14
Final average energy use (ekWhr./sq.ft./year)	29.40	24.51	19.91
Average second year energy savings	11%	6%	1%
Dollar savings for two years	$161,932	$56,927	$ 37,427

*Category I buildings

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ENERGY CONSERVATION

BUILDING OPERATIONS DEMONSTRATION PROJECT

FOR

FORTY HIGH-, MEDIUM- AND LOW-RISE MULTIPLE-UNIT RESIDENTIAL

BUILDINGS

PART 2

DETAILED ACCOUNT OF PROJECT

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1. THE SUMAC ENERGY MANAGEMENT SYSTEM

SUMAC* is a computerized energy analysis program developed by Engineering Interface. Two parts of the program were employed for this project. The Audit was used to analyze previous energy use by the buildings. The Monitor was used to analyze ongoing monthly energy use over the two years of the project.

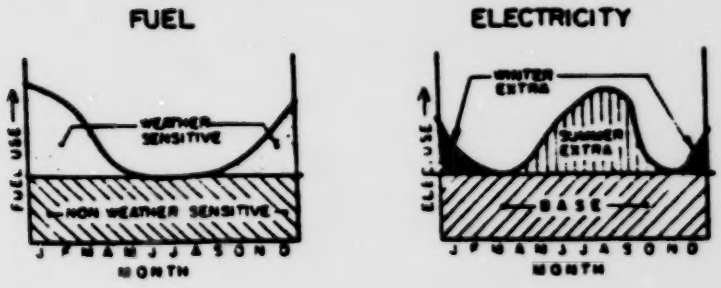
The third element of this project was instructional workshops. These three elements - Audit, Workshops and Monitor - are collectively referred to as the SUMAC Energy Management System. The system is described below:

1.1 Energy Audit

The audit allows detailed comparisons of energy use between buildings to help identify those with the best potential savings. It has three major analytical functions:

- Energy Breakdowns
  The components of fuel and electricity use produced by the audit are shown in simplified diagrammatic form below:

SUMAC ENERGY BREAKDOWNS



*System for Utility Monitoring, Analysis and Control.

Relationships between energy use components and energy using systems in a building are listed in Table 2.1. Unusually high energy use in a particular component indicates potential energy savings in the systems associated with that component. For example, high non-weather sesnitive fuel might point to excessive use of domestic hot water, while high weather sensitive fuel prompts investigation of ventilation systems and heating boilers.

- Normalization

  All energy use components are normalized for billing period variations.

  Heating weather dependent components of energy use are normalized to the weather conditions of a standard year in Toronto. All energy use components may therefore be compared directly, irrespective of the geographic locations of the buildings and of the year of energy use.

- Pattern Analysis

  A building which is operated and controlled in a consistent manner shows consistent seasonal patterns of energy use. Where seasonal patterns are inconsistent, potential savings can be identified. Overheating in mild weather and poor boiler control are common conditions that can be seen and quantified through pattern analysis. SUMAC analysis displays patterns by graphing monthly fuel consumption against degree days.

The energy audits for this project were generated from three previous years' energy use data taken from utility bills for the forty buildings.

TABLE 2.1

ENERGY USE COMPONENTS

Component	Typical Associated Systems
Fuel - Non-Seasonal (Non-weather Sensitive)	. Domestic hot water . Pool heaters . Laundries . Incinerators
Fuel - Seasonal (Weather Sensitive)	. Space heating . Ventilation air heating . Infiltration . Entrance heating
Electricity - Non-Seasonal (Base)	. Lighting . Equipment . Appliances . Fans . Elevators
Electricity - Seasonal (Winter Extra)	. Electric heat . Longer hours of fans and/or lights
Electricity - Seasonal (Summer Extra)	. Air conditioning

Note that monthly electricity consumption and billing demand are each separated into the three electricity use components.

Through the energy audits, participants in the project were shown which buildings were likely to show the best savings, and where those savings were likely to be found.

A shortcoming of the energy audits was that they did not take account of unalterable differences between the buildings. Thus,

buildings with different amounts and types of windows, with different energy systems, and with different occupancy types were all compared directly with each other. The program would have been improved by independent analysis of potential "target" energy savings in each building.

1.2 Workshops

The workshop phase of the project began with a briefing session in October 1981 after which forty buildings were selected to participate in the program. The buildings selected were in two groups: twenty-five medium- and low-rise fuel heated buildings and fifteen high- and medium-rise electrically heated buildings. Eight of the electrically heated buildings also used some fuel and were therefore designated "hybrid".

A series of six half-day workshops followed, spaced at approximately one month intervals. The buildings were divided into eight groups, with four to six buildings at each workshop. The format of the workshop was consistent:

- Review of the monthly energy monitor to identify savings being achieved.
- Discussion of problems encountered in implementing changes proposed in previous sessions.
- Introduction of a new series of proposed changes for the energy systems under review.
- Identification of information required for the next session.

Approximately six months after the final working session during the winter of 1983, a follow-up workshop was held to review longer term results shown on the monitor.

The merits of workshops are as follows:

- changes are more lasting when the building manager implements them himself
- the building manager acquires technical knowledge to help him do his job better
- the cost of the consultant is reduced through "time sharing" among several buildings
- participants learn from each other as well as from the consultant
- peer pressure to achieve the greatest savings develops.

A shortcoming of relying entirely on the workshops was found to be that the consultant does not see the buildings and their systems. Without visits to each building there is potential for missing energy management opportunities. Results of the project could have been improved by including building inspections.

1.3 Energy Monitor

The monitor analyzes energy use taken from ongoing utility bills. It compares current energy use with reference year energy use to produce a monthly report on savings. Savings are shown in energy, dollar and percentage units for fuel, electricity and billing demand.

The monitor normalizes energy use for differences in weather and in billing periods between current and reference years. It prices energy savings at current incremental costs for the month in which they occurred.

The monthly energy monitor provides a necessary feedback function to:

- reassure those doing the work that their endeavours are worthwhile
- provide early warning when unexpected results occur
- motivate those who have yet to take action by quantifying successes of their peers
- show individual effects of sequential actions to identify the most productive ones.

2.0 FINDINGS

2.1 The Energy Audits - Base Year (Sept 1980-Aug 1981)

Base year energy audit results for the thirty-eight apartment buildings which remained in the program are shown in Tables 2.2 through 2.4. Building information is provided in Table 2.5 for reference when reading the audits.

The comparison of base year SUMAC components of all the buildings helped focus attention on buildings and on energy systems within those buildings most likely to provide savings.

The following observations resulted from a comparison of the base year audit components:

- Non-Weather Sensitive Fuel (mostly domestic hot water)
  - . The highest initial use was at 1865 Martingrove at 15.36 ekWhr./sq.ft./year
  - . Eight buildings used more than 10 ekWhr./sq.ft./year. All of these are fuel heated buildings
  - . The lowest use among the buildings with fuel heated non-weather sensitive systems, was at 1290 Danforth, a hybrid building.
  - . The average use for fuel heated buildings was 8.71 ekWhr./sq.ft./year, the average for hybrid buildings was 5.78 ekWhr./sq.ft./year, (excluding Oak Mar, where fuel is used only to heat the garage and the outdoor pool).

  The difference in average non-weather sensitive fuel use between fuel heated and hybrid buildings suggests that heating system losses may contribute to this component in fuel heated buildings, during the heating season.
- Weather Sensitive Fuel (space heating, ventilation, garage heating)
  - . The initial average use for fuel heated buildings was 20.08 ekWhr./sq.ft./year. The average for hybrid buildings was 4.64 ekWhr./sq.ft./year. Hybrid buildings

TABLE 2.2

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1980 - August 1981

FUEL HEATED BUILDING	ENERGY PERFORMANCE (EKWH/SF/YR)								DEMAND PERFORMANCE (WATTS/SF)			
	FUEL			ELECTRICITY					BILLING DEMAND			
	NON-WEATHER SENSITIVE	WEATHER SENSITIVE	TOT	BASE	WINTER EXTRA	SUMMER EXTRA	TOT	GRAND TOTAL	BASE DMD.	WINTER EXTRA	SUMMER EXTRA	TOT
1 THOMSON CT.	5.10	11.30	16.40	6.20	.50	.10	6.8	23.20	1.21	.16	.05	1.42
PALM BEACH	3.72	17.30	21.02	8.20	.41	-.02	8.55	29.57	.81	.16	-.01	.96
105 WINLAINE	5.03	22.74	27.77	5.42	.71	.05	6.18	33.95	1.33	.09	-.03	1.39
LIDO COURT	5.09	14.23	19.32	.72	.13	0	.85	20.17	0	0	0	0
22 FISHLEIGH	6.20	21.40	27.60	4.33	.35	.05	4.73	32.33	1.15	.14	.04	1.33
255 CAPEL	7.09	8.58	15.67	4.21	.18	.43	4.82	20.49	.91	.15	.08	1.14
206 ST.GEORGE	10.49	35.84	46.33	2.70	.47	-.02	3.15	49.48	.69	.05	-.01	.73
330 GERRARD	7.17	16.80	23.97	4.37	.89	.09	5.35	29.32	.87	.22	.04	1.13

(contd)

TABLE 2.2 (contd)

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1980 - August 1981

FUEL HEATED	ENERGY PERFORMANCE (EKWH/SF/YR)								DEMAND PERFORMANCE (WATTS/SF)			
	FUEL			ELECTRICITY					BILLING DEMAND			
BUILDING	NON-WEATHER SENSITIVE	WEATHER SENSITIVE	TOT	BASE	WINTER EXTRA	SUMMER EXTRA	TOT	GRAND TOTAL	BASE DMD.	WINTER EXTRA	SUMMER EXTRA	TOT
95 PAISLEY	10.86	14.83	25.69	4.23	1.24	.15	5.62	31.31	1.0	.23	-.05	1.18
1274 YORK MILLS	9.75	10.32	20.07	1.03	.21	-.02	1.22	21.29	0	0	0	0
1265 SIXTH LINE	10.88	11.19	22.07	3.84	.63	-.08	4.39	26.46	.76	.15	0	.91
1865 MARTINGROVE	15.36	12.36	27.72	3.99	1.11	.33	5.43	33.15	1.05	.09	0	1.14
2258 QUEEN	11.45	54.88	66.33	4.75	.47	.01	5.23	71.56	1.33	.39	-.02	1.70
345 SENTINEL	6.53	20.72	27.25	5.73	.20	.12	6.05	33.30	1.12	.11	.03	1.26
717 EGLINTON	7.92	24.78	32.70	3.76	.70	.10	4.56	37.26	.95	.15	.02	1.12
50 GULLIVER	8.95	21.20	30.15	1.15	.10	.03	1.28	31.43	0	0	0	0

TABLE 2.2 (contd)

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1980 - August 1981

FUEL HEATED	ENERGY PERFORMANCE (EKWH/SF/YR)								DEMAND PERFORMANCE (WATTS/SF)			
	FUEL			ELECTRICITY					BILLING DEMAND			
BUILDING	NON-WEATHER SENSITIVE	WEATHER SENSITIVE	TOT	BASE	WINTER EXTRA	SUMMER EXTRA	TOT	GRAND TOTAL	BASE DMD.	WINTER EXTRA	SUMMER EXTRA	TOT
51 GAMBLE	10.57	22.48	33.05	4.56	.30	-.14	4.72	37.77	1.15	.08	0	1.23
3311 KINGSTON	10.40	20.10	30.50	6.30	1.00	-.10	7.20	37.70	1.16	.26	-.03	1.39
270 CASSANDRA	9.61	20.39	30.00	5.00	.38	-.08	5.30	35.30	1.17	.12	.01	1.30
222 JACKSON	6.79	17.39	24.18	3.82	.09	.80	4.71	28.89	.65	.03	.32	1.00
350 EAST MALL	8.07	23.58	31.65	4.85	.50	.05	5.40	37.05	1.04	.12	.01	1.17
1860 LAWRENCE	15.12	27.17	42.29	10.87	1.05	.02	11.94	54.23	1.78	.25	.05	2.08
141 TAUNTON	7.53	16.42	23.95	4.65	1.33	.07	6.05	30.00	1.09	.23	.01	1.33
14 GULLIVER	9.60	16.21	25.81	1.61	.09	-.03	1.67	27.48	0	0	0	0
AVERAGES	8.71	20.08	28.79	4.43	.54	.08	5.05	33.84	0.88	.13	.02	1.03

TABLE 2.3

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1980 - August 1981

HYBRID HEATED BUILDING	ENERGY PERFORMANCE (EKWH/SF/YR)								DEMAND PERFORMANCE (WATTS/SF)			
	FUEL			ELECTRICITY					BILLING DEMAND			
	NON-WEATHER SENSITIVE	WEATHER SENSITIVE	TOT	BASE	WINTER EXTRA	SUMMER EXTRA	TOT	GRAND TOTAL	BASE DMD.	WINTER EXTRA	SUMMER EXTRA	TOT
MILL ROAD	5.26	1.35	6.61	7.29	6.36	.14	13.79	20.40	1.61	1.02	.09	2.72
251 SHERBOURNE	8.43	6.62	15.05	10.69	8.52	-.46	18.75	33.80	1.47	1.32	-.01	2.78
41 SPEERS	9.76	4.06	13.82	10.73	6.43	1.51	18.67	32.49	1.57	1.09	.68	3.34
1290 DANFORTH	3.43	8.29	11.72	8.41	4.71	.13	13.25	24.97	1.35	1.14	.08	2.57
130 VAUGHAN	3.45	4.76	8.21	7.23	6.66	-.70	13.19	21.40	1.83	.98	-.29	2.52
3025 CREDIT WOODLANDS	3.77	.12	3.89	7.15	3.74	.01	10.90	14.79	1.12	.84	.08	2.04
150 HEATH	6.42	10.54	16.96	11.85	8.94	.46	21.25	38.21	1.44	1.63	.32	3.39
OAKMAR	-.10	1.40	1.30	10.30	8.30	-.10	18.50	19.80	1.31	1.26	.01	2.58
AVERAGES	5.06	4.64	9.70	9.21	6.71	.12	16.04	25.74	1.46	1.16	.12	2.74

TABLE 2.4

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1980 - August 1981

ALL-ELECTRIC	ENERGY PERFORMANCE (EKWH/SF/YR)								DEMAND PERFORMANCE (WATTS/SF)			
	FUEL			ELECTRICITY					BILLING DEMAND			
BUILDING	NON-WEATHER SENSITIVE	WEATHER SENSITIVE	TOT	BASE	WINTER EXTRA	SUMMER EXTRA	TOT	GRAND TOTAL	BASE DMD.	WINTER EXTRA	SUMMER EXTRA	TOT
80 INVERLOCHY	0	0	0	7.52	6.96	.43	14.91	14.91	1.48	1.20	.17	2.85
175 CUMMER	0	0	0	10.06	7.21	.76	18.03	18.03	3.95	.64	-.06	4.53
1350 YORKMILLS	0	0	0	11.71	7.50	-.28	18.93	18.93	2.52	1.29	-.05	3.76
1177 BLOOR ST.	0	0	0	14.48	7.60	-.68	21.40	21.40	3.60	.68	-.33	3.95
3341 FINCH	0	0	0	14.05	9.02	.39	23.46	23.46	3.20	1.77	-.05	4.92
ANTIBES	0	0	0	12.15	11.08	.97	24.20	24.20	2.07	2.34	.27	4.68
AVERAGES				11.66	8.22	0.26	20.14	20.14	2.80	1.32	-.01	4.11

TABLE 2.5

SUMMARY OF BUILDING CHARACTERISTICS

ADDRESS	TYPE	AGE	SUITES	FLOORS	AREA	WINDOWS	AIR CONDITIONING	SNOW MELTING	EXHAUST VENTILATION
FUEL HEATED									
1 THOMSON COURT	SENIOR	UNKNOWN	118	6	89,775	DOUBLE	70%	NONE	INDIVIDUAL
PALM BEACH	ADULT	1950	135	4	142,800	SINGLE & DOUBLE	NONE	NONE	NONE
105 WINLAINE	FAMILY	1970	51	4	42,856	SINGLE	10%	NONE	CENTRAL
LIDO COURT *	ADULT	1956	33	3	35,100	SINGLE	6%	NONE	CENTRAL
22 FISHLEIGH	FAMILY, CO-OP	1952	48	3	42,290	SINGLE	NONE	NONE	NONE
255 CAPEL	ADULT	1974	62	8	57,300	DOUBLE	10%	NONE	CENTRAL
206 ST.GEORGE*	ADULT	1955	103	11	74,180	SINGLE	NONE	NONE	CENTRAL
330 GERRARD	SENIOR, NON-PROFIT	1972	81	7	78,078	DOUBLE	15%	ELECTRIC	INDIVIDUAL
95 PAISLEY	FAMILY	1968	59	9	62,200	SINGLE	10%	NONE	CENTRAL
1274 YORK MILLS*	FAMILY	1958	63	7	79,393	SINGLE	10%	NONE	CENTRAL
1265 SIXTH LINE	FAMILY	1970	94	7	141,282	SINGLE	NONE	ELECTRIC	CENTRAL
1865 MARTINGROVE	FAMILY	1969	91	12	106,700	SINGLE	20%	ELECTRIC	CENTRAL
2258 QUEEN ST.	FAMILY	1928	28	4	17,120	SINGLE	NONE	NONE	INDIVIDUAL
345 SENTINEL	ADULT	1971	79	10	134,960	SINGLE	20%	GLYCOL	CENTRAL

* = Independent electric metering of suites

(contd)

TABLE 2.5 (contd)

ADDRESS	TYPE	AGE	SUITES	FLOORS	AREA	WINDOWS	AIR CONDITIONING	SNOW MELTING	EXHAUST VENTILATION
717 EGLINTON[t]	ADULT	1960	51	6	52,890	SINGLE	50%	NONE	CENTRAL
50 GULLIVER *	FAMILY, CO-OP	UNKNOWN	63	6	60,495	SINGLE	10%	NONE	CENTRAL
51 GAMBLE	FAMILY	1962	49	6	47,300	SINGLE	NONE	NONE	CENTRAL
3311 KINGSTON RD.	FAMILY, CO-OP	1969	151	13	149,500	SINGLE	10%	ELECTRIC	CENTRAL
270 CASSANDRA	FAMILY	1967	83	4	27,830	SINGLE	14%	GLYCOL	CENTRAL
222 JACKSON *	ADULT, CONDOMINIUM	1979	87	15	134,775	DOUBLE	CENTRAL	NONE	CENTRAL
350 EAST MALL	FAMILY	1965	77	8	82,832	SINGLE	25%	NONE	CENTRAL
1860 LAWRENCE	SENIOR	1978	246	8	141,535	DOUBLE	5%	NONE	CENTRAL
141 TAUNTON	FAMILY	1970	54	5	62,895	SINGLE	10%	ELECTRIC	CENTRAL
14 GULLIVER *	FAMILY	1963	57	6	63,201	SINGLE	30%	NONE	CENTRAL
HYBRID									
284 & 300 MILL RD[t,o]	FAMILY, CONDOMINIUM	1976	506	16	722,400	DOUBLE	100%	NONE	INDIVIDUAL
251 SHERBOURNE	FAMILY, NON-PROFIT	1976	302	7	157,536	SINGLE	NONE	ELECTRIC	INDIVIDUAL
41 SPEERS[t,o]	ADULT	UNKNOWN	135	17	133,995	DOUBLE	100%	ELECTRIC	INDIVIDUAL
1290 DANFORTH	SENIOR, NON-PROFIT	1977	179	8	86,453	DOUBLE	33%	NONE	INDIVIDUAL

(contd)

t = thermostatic control of heating in suites * = Independent electric metering of suites
o = heated swimming pool

TABLE 2.5 (contd)

ADDRESS	TYPE	AGE	SUITES	FLOORS	AREA	WINDOWS	AIR CONDITIONING	SNOW MELTING	EXHAUST VENTILATION
130 VAUGHAN	SENIOR NON-PROFIT	1978	99	8	64,896	DOUBLE	NONE	NONE	INDIVIDUAL
3025 CREDIT WOODLANDS[o]	FAMILY, CONDOMINIUM	1977	176	6	328,320	DOUBLE	100%	ELECTRIC	INDIVIDUAL
150 HEATH[t]	ADULT, CONDOMINIUM	1976	46	13	107,653	DOUBLE	CENTRAL	GLYCOL	INDIVIDUAL
OAK MAR[t,o]	ADULT	1965	94	12	95,090	DOUBLE	30%	ELECTRIC	CENTRAL
ALL-ELECTRIC									
80 INVERLOCHY[t]	FAMILY CONDOMINIUM	1974	139	13	187,600	DOUBLE	NONE	ELECTRIC	INDIVIDUAL & CENTRAL
175 CUMMER	SENIOR NON-PROFIT	1967	287	4	162,240	DOUBLE	27%	NONE	CENTRAL
1350 YORK MILLS[t]	FAMILY, CONDOMINIUM	1970	376	21	449,445	DOUBLE	25%	ELECTRIC	INDIVIDUAL
1177 BLOOR[o]	ADULT	1969	174	11	156,445	SINGLE	NONE	ELECTRIC	CENTRAL
3341 FINCH	SENIOR, NON-PROFIT	1978	259	6	155,235	DOUBLE	15%	NONE	INDIVIDUAL
115-135 ANTIBES	FAMILY, CONDOMINIUM	1971	256	26	344,011	DOUBLE	100%	ELECTRIC	CENTRAL

[t] = thermostatic control of heating in suites

[o] = heated swimming pool

use electricity as their primary heating source. Most weather sensitive gas use in hybrid buildings is for heating corridor make up air.

. The highest initial user among fuel heated buildings was 2258 Queen Street, at 54.88 ekWhr./sq.ft./year.

. The lowest was 1274 York Mills, at 10.32 ekWhr./sq.ft./year.

. Among the hybrid buildings, the highest initial user was 1290 Danforth, at 8.29 ekWhr./sq.ft./year. This building has a gas-fired boiler for heating ventilation air, in addition to electric heat.

. The lowest user of the buildings with gas heating was 284 and 300 Mill Road. These buildings have gas heated corridor supply only.

. For hybrid buildings, magnitude of weather sensitive fuel use is determined by the systems which use fuel. Among the fuel heated buildings, age of the building, and window area and type (single or double) are major factors in determining weather sensitive energy performance.

- Base Electricity (lights, fans, appliances)

. The highest user of base electricity in the base year was 1177 Bloor St., (14.48 kWhr./sq.ft./year), an all-electric adult rental building. There was no unusual equipment or occupancy pattern in this building to explain the high use relative to other all-electric buildings.

. The lowest base electrical energy user by far was Lido Court, at .72 kWhr./sq.ft./year. This represents common area electricity use only, since suites are metered separately.

. The average use among the seven condominium buildings was 8.78 kWhr./sq.ft./year. The average for the remaining buildings was 6.08 kWhr./sq.ft./year. Condominiums use more electricity per sq.ft. for lights, fans and appliances than rental buildings. Suite size is larger on the average, in condominium buildings, so

that the difference in base energy use per suite between condominium and rental building is even greater.

. The average base electric demand was 1.25 W/sq.ft. among the rental buildings and 1.55 W/sq.ft. among the condominiums.

. The building with the highest initial base demand was 175 Cummer, an all-electric, non-profit seniors' building, at 3.9 W/sq.ft. Control problems were identified as the cause of this.

. Smaller buildings were not charged for demand on electric bills, making it difficult to determine the lowest user. Of the buildings with demand data recorded, 222 Jackson had the lowest at .65 W/sq.ft.

- Winter Extra Electricity (ramp and garage heaters, in suite heating, longer hours of lighting and appliance use)

. The average winter extra electricity consumption for fuel heated buildings was .54 kWhr./sq.ft./year. Average demand was .13 W/sq.ft. Four of these buildings have some electric space heating.

. The highest consumption was at 141 Taunton (1.33 kWhr./sq.ft./year) which has an electric heated ramp. Tenants also use electric heaters in suites.

. The lowest was at 14 Gulliver, which has no electric heating.

. For hybrid buildings, average winter extra consumption was 6.71 kWhr./sq.ft./year. Average demand was 1.16 W/sq.ft.

. The highest consumption was at 150 Heath (11.85 kWhr./sq.ft./year), although this luxury condominium uses gas corridor humidification and heating.

. The lowest consumption was 4.71 kWhr./sq.ft./year at 1290 Danforth. This non-profit seniors' building also uses electric heating in the suites only.

. The all-electric building averages were 8.22 kWhr./sq.ft./year for consumption and 1.32 W/sq.ft. for winter extra demand.

. The highest user was 115-135 Antibes, at 11.08 kWhr./sq.ft./year.

. The lowest user was 80 Inverlochy, at 6.96 kWhr/sq.ft./year. Both buildings are family condominiums with double glazed windows. Inverlochy has radiant ceiling heating with thermostats in the suites, while Antibes has incremental units. Both have heated ramps.

- Summer Extra Electricity (air conditioning)

. Two of the thirty-eight buildings have central air conditioning (222 Jackson and 150 Heath), four have window units in 100 percent of the suites (Mill Road, 3025 Credit Woodlands, Antibes and 41 Speers). All of these buildings, except 41 Speers, are condominiums. Ten buildings were reported to have no air conditioning. One of these (80 Inverlochy) is a condominium. All other buildings ranged from 5 to 70 percent air conditioned by window units.

. The average summer extra electricity consumption was .12 kWhr./sq.ft./year, the demand average was .04 W/sq.ft.

. The highest use was 1.51 kWhr./sq.ft./year at 41 Speers, which has window air conditioners in 100 percent of its suites.

. The lowest use was -.70 W/sq.ft., at 130 Vaughan Rd. The negative indicates a reduction in occupancy or in use of lights and appliances in the summer months. This non-profit seniors' building has no air conditioning.

. The condominium average was .79 kWhr./sq.ft./year. The rental average was -.03 kWhr./sq.ft./year, indicating much lower use of air conditioning in rental buildings than in condominiums.

2.2 Workshops - Action

Over the six month period from December 1981 to May 1982, all of the major energy using systems in the buildings were studied. Each of the buildings presented a different set of energy management opportunities. Actions taken in the buildings are summarized together with total expenditures in Table 2.6. The actions are rated according to their estimated returns on investment. Work on ventilation systems is seen to be the most common action, and has the same rating for return on investment as changes to boilers and heating systems. Lighting conversions are likely to be the largest investments in buildings where changes are justified, and had the poorest return on investment of the changes made in this project. Changes to domestic hot water systems are also likely to have wide applicability. The high R.O.I. actions in this category are mostly for lowering the temperature of domestic hot water. Poorer ratings are for more expensive changes such as insulation.

TABLE 2.6

SYSTEMS MODIFIED AT THE BUILDINGS
IN ORDER OF ESTIMATED RETURN ON INVESTMENT (1 = BEST)

ADDRESS	LIGHTING	VENTILATION	RAMP HEATER	GARAGE HEAT & VENT	HEATING BOILERS	HEATING SYSTEM	DOMESTIC HOT WATER	TOTAL EXPENDITURES
FUEL HEATED								
1 THOMSON CT.	-	3	-	-	-	2	1	$ 300
PALM BEACH	-	-	-	-	-	-	-	N/A
105 WINLAINE	-	1	-	-	-	2	3	4,200
LIDO COURT	-	-	-	-	-	-	-	N/A
22 FISHLEIGH	-	-	-	-	-	-	-	N/A
255 CAPEL	-	1	-	-	-	2	-	300
206 ST.GEORGE	5	3	-	-	4	2	1	2,025
330 GERRARD	-	1	-	-	-	-	-	360
95 PAISLEY	-	3	-	-	1	2	4	1,430
1274 YORKMILLS	2	-	-	-	1	-	-	0
1265 SIXTH LINE	3	2	-	-	-	1	-	3,900
1865 MARTINGROVE	-	2	-	-	1	-	3	270
2258 QUEEN ST.	-	-	-	-	-	-	-	N/A

TABLE 2.6 (contd)

ADDRESS	LIGHTING	VENTILATION	RAMP HEATER	GARAGE HEAT & VENT	HEATING BOILERS	HEATING SYSTEM	DOMESTIC HOT WATER	TOTAL EXPENDITURES
345 SENTINEL	4	3	-	-	-	1	2	2,700
717 EGLINTON	4	2	-	-	1	-	3	1,140
50 GULLIVER	-	2	-	-	-	1	-	2,100
51 GAMBLE	-	-	-	-	1	2	3	10,000
3311 KINGSTON RD.	4	2	-	-	-	1	3	7,580
270 CASSANDRA	-	-	2	3	-	1	4	4,900
222 JACKSON	-	1	-	-	-	2	3	6,000
350 EAST MALL	-	2	-	-	-	1	3	3,720
1860 LAWRENCE	-	1	-	-	2	3	-	1,730
141 TAUNTON	-	2	1	-	-	-	3	950
14 GULLIVER	3	2	-	-	-	1	4	900
HYBRID								
MILL ROAD	-	1	-	-	-	-	2	15,000
251 SHERBOURNE	-	1	2	-	-	-	-	300
41 SPEERS	-	1	-	-	-	-	-	300
1290 DANFORTH	4	1	-	-	-	2	3	900

TABLE 2.6 (contd)

ADDRESS	LIGHTING	VENTILATION	RAMP HEATER	GARAGE HEAT & VENT	HEATING BOILERS	HEATING SYSTEM	DOMESTIC HOT WATER	TOTAL EXPENDITURES
130 VAUGHAN	1	1	-	-	-	-	1	700
3025 CREDIT WOODLANDS	4	1	-	-	-	2	3	700
150 HEATH	-	1	-	-	-	-	-	1,380
OAK MAR	4	1	-	2	-	-	3	4,900
ALL-ELECTRIC								
80 INVERLOCHY	-	1	-	-	-	-	-	225
175 CUMMER	3	1	-	-	-	-	2	5,400
1350 YORK MILLS	3	2	4	-	-	-	1	23,000
1177 BLOOR	-	2	-	-	-	-	1	550
3341 FINCH	3	1	-	-	-	-	2	1,200
115-135 ANTIBES	-	1	-	-	-	-	2	-
AVERAGE	2.8	1.6	2.2	2.5	1.6	1.6	2.5	
COUNT	14	31	4	2	7	17	24	

2.3 The Energy Monitor

Two of the buildings chosen for this project are not represented in this report. 263 Ontario Street left after its owner went into receivership. 8111 Yonge Street discontinued their participation in the first monitor year.

Monthly energy use by the remaining thirty-eight buildings was monitored for two years. The first year, September 1981 - August 1982, covered three months before the project began, six months during which energy conserving charges were being made and three months after implementation was generally complete. The second year, September 1982 - August 1983, showed the complete results of the project.

Overall energy savings of five percent were achieved in the first year. Those savings increased to 10 percent in the second year. Total dollar savings were $78,140 in the first year and $155,380 in the second.

2.4 First and Second Year Component Energy Use

The eight energy use components for each of the buildings for the first monitor year are contained in Tables 2.7 (fuel heated), 2.8 (hybrid) and 2.9 (all-electric). Tables 2.10 to 2.12 contain second year components in the same order. The savings reflected in these tables relative to those in Tables 2.2 to 2.4 are summarized below:

Fuel Heated Buildings

	NWS FUEL	WS FUEL	BASE ELEC	WINTER EXTRA ELEC	SUMMER EXTRA ELEC	TOTAL
YEAR 1	11% Savings	10% Savings	12% Savings	67% Increase	75% Savings	6% Savings
YEAR 2	15% Savings	15% Savings	6% Savings	30% Increase	125% Savings	13% Savings

Hybrid Buildings

	NWS FUEL	WS FUEL	BASE ELEC	WINTER EXTRA ELEC	SUMMER EXTRA ELEC	TOTAL
YEAR 1	3% Increase	21% Savings	9% Savings	9% Increase	1% Savings	5% Savings
YEAR 2	0.3% Increase	25% Savings	9% Savings	7% Increase	200% Increase	5% Savings

All-Electric Buildings

	NWS FUEL	WS FUEL	BASE ELEC	WINTER EXTRA ELEC	SUMMER EXTRA ELEC	TOTAL
YEAR 1	-	-	6% Savings	8% Increase	54% Savings	1% Savings
YEAR 2	-	-	4% Savings	4% Increase	42% Savings	1% Savings

Overall savings resulted primarily from improvement in weather sensitive fuel performance in the fuel heated and hybrid buildings. This improvement was offset by increases in winter

extra electricity use in both years in fuel heated, hybrid and (surprisingly) all-electric buildings. Increases in winter extra electricity use are attributed to increased use of electric heat by residents.

Decreased non-weather sensitive fuel consumption in fuel heated buildings also made a large contribution to the savings.

Net base electricity savings were made for all three heating system types.

TABLE 2.7

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1981 - August 1982

FUEL HEATED BUILDING	ENERGY PERFORMANCE (EKWH/SF/YR) FUEL: NON-WEATHER SENSITIVE	FUEL: WEATHER SENSITIVE	FUEL: TOT	ELECTRICITY: BASE	ELECTRICITY: WINTER EXTRA	ELECTRICITY: SUMMER EXTRA	ELECTRICITY: TOT	GRAND TOTAL	DEMAND PERFORMANCE (WATTS/SF) BILLING DEMAND: BASE DMD.	BILLING DEMAND: WINTER EXTRA	BILLING DEMAND: SUMMER EXTRA	BILLING DEMAND: TOT
1 THOMSON CT	5.25	11.15	16.40	5.73	.84	.08	6.65	23.20	1.21	.02	.20	1.43
PALM BEACH	2.96	14.48	17.45	2.07	5.90	-.45	7.52	24.96	.65	.22	-.14	.73
105 WINLAINE	7.89	19.05	26.94	3.64	2.27	.06	5.98	32.91	1.49	.31	-.27	1.52
LIDO COURT	5.09	15.39	20.48	.78	.08	0	.86	21.33	0	0	0	0
22 FISHLEIGH	7.48	17.64	25.12	4.80	.03	.26	5.10	30.21	1.36	-.10	.19	1.44
255 CAPEL	3.91	11.76	15.67	4.59	.06	.32	4.97	20.64	1.06	-.03	.08	1.11
206 ST.GEORGE	10.50	36.30	46.79	1.89	.74	.05	2.68	49.47	.61	.05	.01	.68
330 GERRARD	7.91	14.62	22.53	4.03	1.19	.20	5.42	27.95	1.13	-.01	-.03	1.09

(contd)

TABLE 2.7 (contd)

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1981 - August 1982

FUEL HEATED	ENERGY PERFORMANCE (EKWH/SF/YR)								DEMAND PERFORMANCE (WATTS/SF)			
	FUEL			ELECTRICITY					BILLING DEMAND			
BUILDING	NON-WEATHER SENSITIVE	WEATHER SENSITIVE	TOT	BASE	WINTER EXTRA	SUMMER EXTRA	TOT	GRAND TOTAL	BASE DMD.	WINTER EXTRA	SUMMER EXTRA	TOT
95 PAISLEY	6.82	17.07	23.89	3.60	2.01	.11	5.65	29.54	.74	.40	.05	1.19
1274 YORK MILLS	9.20	8.86	18.06	1.12	.11	-.13	1.09	19.15	0	0	0	0
1265 SIXTH LINE	4.37	14.83	19.20	3.50	.20	-.22	3.49	22.69	.71	.14	-.01	.83
1865 MARTINGROVE	9.48	14.36	23.84	4.77	.82	.15	5.73	29.57	1.01	.34	-.05	1.30
2258 QUEEN	14.49	31.28	45.77	4.64	.44	.06	5.14	50.90	1.55	-.20	.15	1.49
345 SENTINEL	3.74	23.51	27.25	4.65	.90	-.32	5.22	32.47	1.06	.20	-.10	1.16
717 EGLINTON	6.29	20.52	26.81	2.84	.95	.05	3.84	30.65	1.07	.03	.01	1.11
50 GULLIVER	8.95	22.41	31.36	1.17	.20	.03	1.40	32.76	0	0	0	0

(contd)

TABLE 2.7 (contd)

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1981 - August 1982

FUEL HEATED	ENERGY PERFORMANCE (EKWH/SF/YR)								DEMAND PERFORMANCE (WATTS/SF)			
	FUEL			ELECTRICITY					BILLING DEMAND			
BUILDING	NON-WEATHER SENSITIVE	WEATHER SENSITIVE	TOT	BASE	WINTER EXTRA	SUMMER EXTRA	TOT	GRAND TOTAL	BASE DMD.	WINTER EXTRA	SUMMER EXTRA	TOT
51 GAMBLE	10.57	23.14	33.71	4.60	.24	0	4.84	38.55	1.11	.10	-.02	1.20
3311 KINGSTON	11.07	19.43	30.50	6.09	.82	-.15	6.76	37.26	1.26	.15	-.01	1.40
270 CASSANDRA	8.28	22.32	30.60	5.00	.44	.01	5.45	36.05	1.12	.27	-.10	1.29
222 JACKSON	5.49	15.79	21.28	3.07	.63	.63	4.33	25.60	.66	.06	.38	1.10
350 EAST MALL	7.23	23.16	30.38	4.13	.96	-.14	4.95	35.34	.85	.31	-.06	1.10
1860 LAWRENCE	14.09	27.78	41.87	10.88	1.03	0	11.91	53.78	1.77	.18	.11	2.07
141 TAUNTON	6.56	16.67	23.23	4.22	.71	.03	4.97	28.20	.95	.31	-.03	1.23
14 GULLIVER	8.01	16.00	24.00	1.45	.12	-.04	1.52	25.53	0	0	0	0
AVERAGES	7.73	19.06	26.79	3.89	.90	.02	4.81	31.60	.89	.11	.01	1.01

TABLE 2.8

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1981 - August 1982

HYBRID HEATED BUILDING	ENERGY PERFORMANCE (EKWH/SF/YR)								DEMAND PERFORMANCE (WATTS/SF)			
	FUEL			ELECTRICITY					BILLING DEMAND			
	NON-WEATHER SENSITIVE	WEATHER SENSITIVE	TOT	BASE	WINTER EXTRA	SUMMER EXTRA	TOT	GRAND TOTAL	BASE DMD.	WINTER EXTRA	SUMMER EXTRA	TOT
MILL ROAD	5.72	1.09	6.81	7.87	5.46	.41	13.74	20.55	1.72	1.04	.17	2.93
251 SHERBOURNE	8.96	2.93	11.89	9.45	9.86	-.65	18.66	30.55	1.13	1.82	.02	2.97
41 SPEERS	8.72	3.86	12.58	10.5	7.11	.63	18.25	30.82	2.23	1.37	.13	3.73
1290 DANFORTH	3.12	7.07	10.20	7.86	5.27	-.20	12.93	23.12	1.28	1.37	-.07	2.57
130 VAUGHAN	3.97	3.58	7.55	6.22	7.45	-.70	12.96	20.52	1.29	1.29	-.31	2.27
3025 CREDIT WOODLANDS	4.04	.59	4.63	7.05	5.14	.12	12.32	16.95	1.64	.20	.39	2.24
150 HEATH	7.17	9.28	16.45	8.50	9.60	.40	18.5	34.95	1.36	1.67	-.04	2.97
OAKMAR	-.16	1.09	.94	9.30	8.61	0	17.9	18.84	1.26	1.20	.25	2.70
AVERAGES	5.19	3.69	8.88	8.34	7.31	.001	15.65	24.53	1.49	1.25	.07	2.81

TABLE 2.9

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1981 - August 1982

ALL-ELECTRIC	ENERGY PERFORMANCE (EKWH/SF/YR)								DEMAND PERFORMANCE (WATTS/SF)			
	FUEL			ELECTRICITY					BILLING DEMAND			
BUILDING	NON-WEATHER SENSITIVE	WEATHER SENSITIVE	TOT	BASE	WINTER EXTRA	SUMMER EXTRA	TOT	GRAND TOTAL	BASE DMD.	WINTER EXTRA	SUMMER EXTRA	TOT
80 INVERLOCHY	0	0	0	5.76	8.83	.57	15.15	15.15	1.07	1.64	-.10	2.61
175 CUMMER	0	0	0	9.08	8.15	.68	17.91	17.91	3.35	1.59	-1.00	3.95
1350 YORKMILLS	0	0	0	10.50	8.35	-.58	18.27	18.27	2.14	1.56	-.08	3.62
1177 BLOOR ST.	0	0	0	16.72	6.10	-.53	22.29	22.29	4.53	.50	-.41	4.62
3341 FINCH	0	0	0	12.71	9.88	.11	22.71	22.71	3.39	1.65	-.25	4.80
ANTIBES	0	0	0	11.08	11.94	.45	23.47	23.47	1.81	2.67	-.04	4.44
AVERAGES				10.98	8.88	.12	19.98	19.98	2.72	1.60	-.13	4.19

TABLE 2.10

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1982 - August 1983

FUEL HEATED BUILDING	ENERGY PERFORMANCE (EKWH/SF/YR) FUEL: NON-WEATHER SENSITIVE	FUEL: WEATHER SENSITIVE	FUEL: TOT	ELECTRICITY: BASE	ELECTRICITY: WINTER EXTRA	ELECTRICITY: SUMMER EXTRA	ELECTRICITY: TOT	GRAND TOTAL	DEMAND PERFORMANCE (WATTS/SF) BILLING DEMAND: BASE DMD.	BILLING DEMAND: WINTER EXTRA	BILLING DEMAND: SUMMER EXTRA	BILLING DEMAND: TOT
1 THOMSON CT.	5.52	10.22	15.74	6.07	.57	.29	6.93	22.67	1.31	.03	.10	1.45
PALM BEACH	6.73	13.66	20.39	2.52	5.41	-.40	7.55	27.92	.67	.21	-.13	.75
105 WINLAINE	5.28	21.37	26.66	5.87	.35	.08	6.30	32.96	1.61	-.05	-.02	1.54
LIDO COURT	5.09	9.79	14.88	.81	.03	.02	.86	15.74	0	0	0	0
22 FISHLEIGH	11.67	13.99	25.67	4.84	.11	.52	5.47	31.14	1.36	-.13	.24	1.47
255 CAPEL	3.91	8.31	12.22	3.85	.65	.25	4.75	16.97	.50	.51	-.07	.94
206 ST.GEORGE	9.41	36.46	45.87	2.36	.23	.26	2.85	48.72	.67	-.01	.05	.71
330 GERRARD	7.52	16.21	23.73	2.77	2.12	.08	4.97	28.70	.94	.06	.11	1.11

(contd)

TABLE 2.10 (contd)

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1982 - August 1983

FUEL HEATED	ENERGY PERFORMANCE (EKWH/SF/YR)								DEMAND PERFORMANCE (WATTS/SF)			
	FUEL			ELECTRICITY					BILLING DEMAND			
BUILDING	NON-WEATHER SENSITIVE	WEATHER SENSITIVE	TOT	BASE	WINTER EXTRA	SUMMER EXTRA	TOT	GRAND TOTAL	BASE DMD.	WINTER EXTRA	SUMMER EXTRA	TOT
95 PAISLEY	7.82	13.24	21.07	3.61	2.05	.26	5.91	26.98	.98	.08	.13	1.19
1274 YORK MILLS	7.95	9.71	17.66	.98	.07	-.05	1.00	18.66	0	0	0	0
1265 SIXTH LINE	2.76	13.13	15.89	3.80	-.25	-.09	3.45	19.34	.84	.01	.06	.91
1865 MARTINGROVE	15.62	9.05	24.67	5.10	.05	.54	5.69	30.36	1.12	.10	.02	1.24
2258 QUEEN	14.08	27.71	41.79	4.78	.42	.36	5.56	47.35	1.64	-.25	.15	1.54
345 SENTINEL	6.24	19.11	25.34	4.98	.52	-.10	5.39	30.73	1.21	-.05	-.05	1.11
717 EGLINTON	8.19	19.93	28.12	3.71	.24	.03	3.97	32.09	1.00	.06	.03	1.08
50 GULLIVER	6.19	20.34	26.53	1.23	.04	-.01	1.25	27.78	0	0	0	0

(contd)

TABLE 2.10 (contd)

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1982 - August 1983)

FUEL HEATED BUILDING	ENERGY PERFORMANCE (EKWH/SF/YR) FUEL: NON-WEATHER SENSITIVE	FUEL: WEATHER SENSITIVE	FUEL: TOT	ELECTRICITY: BASE	ELECTRICITY: WINTER EXTRA	ELECTRICITY: SUMMER EXTRA	ELECTRICITY: TOT	GRAND TOTAL	DEMAND PERFORMANCE (WATTS/SF) BILLING DEMAND: BASE DMD.	BILLING DEMAND: WINTER EXTRA	BILLING DEMAND: SUMMER EXTRA	BILLING DEMAND: TOT
51 GAMBLE	4.22	18.25	22.47	4.51	-.07	.03	4.47	26.95	1.08	.13	-.04	1.17
3311 KINGSTON	8.30	21.28	29.59	6.04	.72	-.11	6.65	36.23	1.31	.01	.03	1.35
270 CASSANDRA	8.35	19.25	27.60	5.09	.37	.26	5.71	33.31	1.21	.09	.03	1.33
222 JACKSON	5.00	12.65	17.65	3.37	.22	.70	4.29	21.94	.75	-.07	.40	1.07
350 EAST MALL	7.69	19.85	27.54	4.72	.43	.13	5.29	32.82	1.20	-.09	.09	1.20
1860 LAWRENCE	13.94	24.12	38.06	10.13	1.56	-.12	11.57	49.63	1.75	.21	-.02	1.95
141 TAUNTON	7.15	16.32	23.47	4.34	.45	.17	4.96	28.43	.91	.25	0.05	1.11
14 GULLIVER	7.54	17.49	25.04	1.41	.07	-.05	1.42	26.46	0	0	0	0
AVERAGES	7.42	17.14	24.56	4.16	.70	-.02	4.84	29.40	.92	.04	.05	1.01

TABLE 2.11

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1982 - August 1983

HYBRID HEATED BUILDING	ENERGY PERFORMANCE (EKWH/SF/YR) FUEL: NON-WEATHER SENSITIVE	FUEL: WEATHER SENSITIVE	FUEL: TOT	ELECTRICITY: BASE	ELECTRICITY: WINTER EXTRA	ELECTRICITY: SUMMER EXTRA	ELECTRICITY: TOT	GRAND TOTAL	DEMAND PERFORMANCE (WATTS/SF) - BILLING DEMAND: BASE DMD.	BILLING DEMAND: WINTER EXTRA	BILLING DEMAND: SUMMER EXTRA	BILLING DEMAND: TOT
MILL ROAD	5.57	1.04	6.61	7.27	6.04	.95	14.26	20.87	1.85	.54	.35	2.74
251 SHERBOURNE	7.98	4.06	12.04	10.00	10.19	-.26	19.93	31.97	1.84	.86	.22	2.92
41 SPEERS	8.46	5.64	14.10	10.17	6.64	1.35	18.16	32.25	2.08	.96	.72	3.76
1290 DANFORTH	3.08	4.65	7.74	8.00	4.95	-.03	12.92	20.66	1.31	1.31	.02	2.64
130 VAUGHAN	4.30	2.60	6.90	4.59	8.46	-.61	12.44	19.33	1.49	1.08	-.13	2.44
3025 CREDIT WOODLANDS	3.46	1.24	4.71	7.05	3.91	.50	11.47	16.17	1.64	-.03	.37	1.97
150 HEATH	7.85	8.10	15.94	9.60	9.73	.72	20.04	35.98	1.49	1.61	.01	3.11
OAKMAR	-.10	.55	.46	10.18	7.77	.38	18.33	18.78	1.06	1.39	.08	2.53
AVERAGES	5.08	3.48	8.56	8.36	7.21	.38	15.95	24.51	1.60	.96	.20	2.76

TABLE 2.12

SUMAC

BUILDING ENERGY AUDIT

Energy Use from September 1982 - August 1983

	ENERGY PERFORMANCE (EKWH/SF/YR)								DEMAND PERFORMANCE (WATTS/SF)			
ALL-ELECTRIC	FUEL			ELECTRICITY					BILLING DEMAND			
BUILDING	NON-WEATHER SENSITIVE	WEATHER SENSITIVE	TOT	BASE	WINTER EXTRA	SUMMER EXTRA	TOT	GRAND TOTAL	BASE DMD.	WINTER EXTRA	SUMMER EXTRA	TOT
80 INVERLOCHY	0	0	0	8.54	5.72	.75	15.01	15.01	1.12	1.41	-.09	2.43
175 CUMMER	0	0	0	9.77	7.77	.45	17.99	17.99	4.11	.67	.13	4.90
1350 YORKMILLS	0	0	0	10.44	7.94	-.52	17.86	17.86	1.79	1.82	-.32	3.29
1177 BLOOR ST.	0	0	0	13.2	9.50	-1.73	20.96	20.96	3.85	1.11	-1.14	3.83
3341 FINCH	0	0	0	13.31	9.33	.42	23.06	23.06	3.01	1.76	-.20	4.56
ANTIBES	0	0	0	11.80	11.19	1.50	24.50	24.50	1.73	2.38	.37	4.49
AVERAGES				11.18	8.58	.15	19.91	19.91	2.60	1.52	-.21	3.91

3.0 CONCLUSIONS

3.1 Categorization of Buildings According to Results Achieved

Total energy use per square foot for the year before the project began (1980/81) and for each of the two years of the project (1981/82 and 1982/83) are shown for the fuel heated, hybrid and all-electric buildings in Figure 2.1, 2.2 and 2.3, respectively.

These figures show average energy use reductions from 1980/81 to 1982/83 of 13 percent from 33.84 to 29.4 ekWhr./sq.ft./year for fuel heated buildings; 5 percent reduction from 25.74 to 24.51 ekWhr./sq.ft./year for hybrid buildings; and 1 percent reduction from 20.14 to 19.91 ekWhr./sq.ft./year for all-electric buildings.

Four patterns of change in energy use were observed from these figures. The patterns are categorized as follows:

- Category I (13 fuel heated; 3 hybrid; 2 all-electric)
  Energy cost savings achieved in first year were substantially increased in second year.

- Category II (4 fuel heated; 3 hybrid; 1 all-electric)
  Marked reversal in results between first and second year.

- Category III (5 fuel heated; 1 all-electric)
  No significant change in energy use during the project.

- Category IV (2 fuel heated; 2 hybrid; 2 all-electric)
  Factors not related to project affected pattern of change of energy use.

FIG 2.1A : ENERGY USE SUMMARY FUEL HEATED

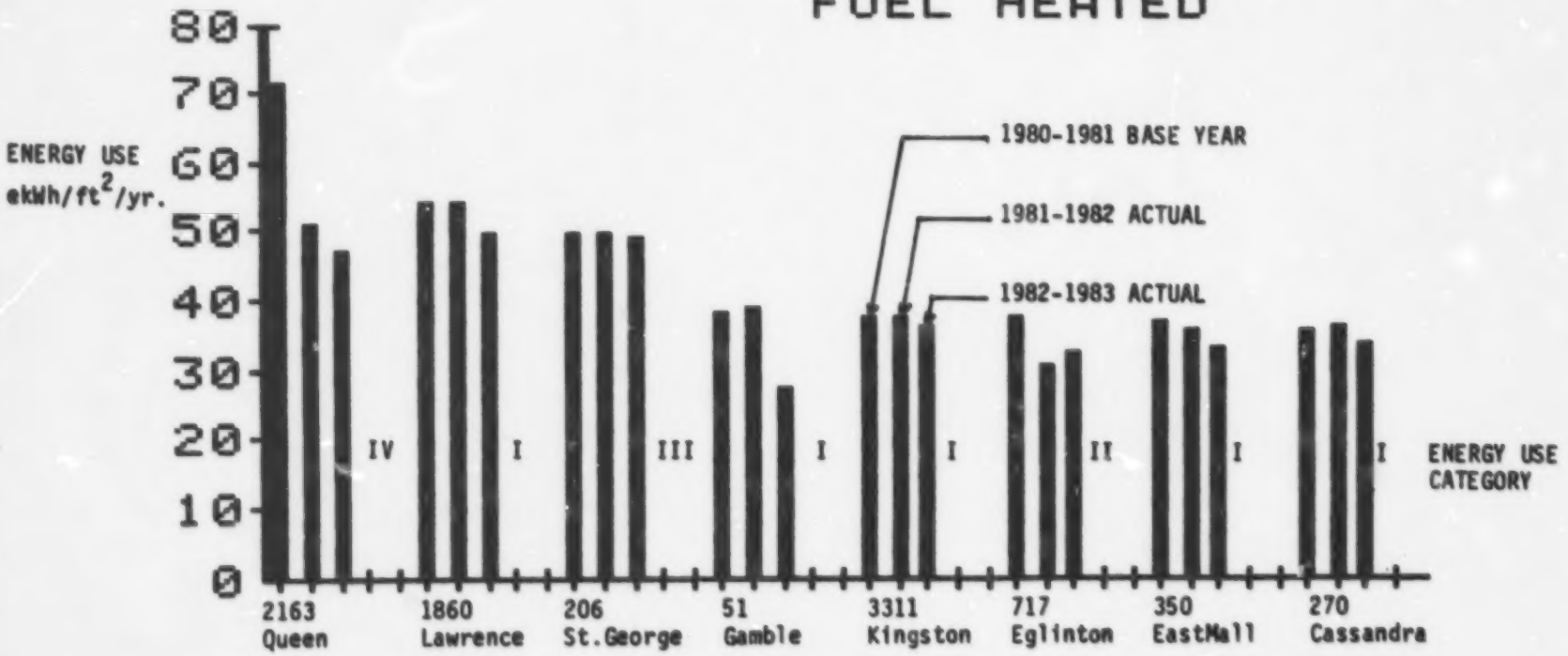


FIG 2.1B : ENERGY USE SUMMARY FUEL HEATED

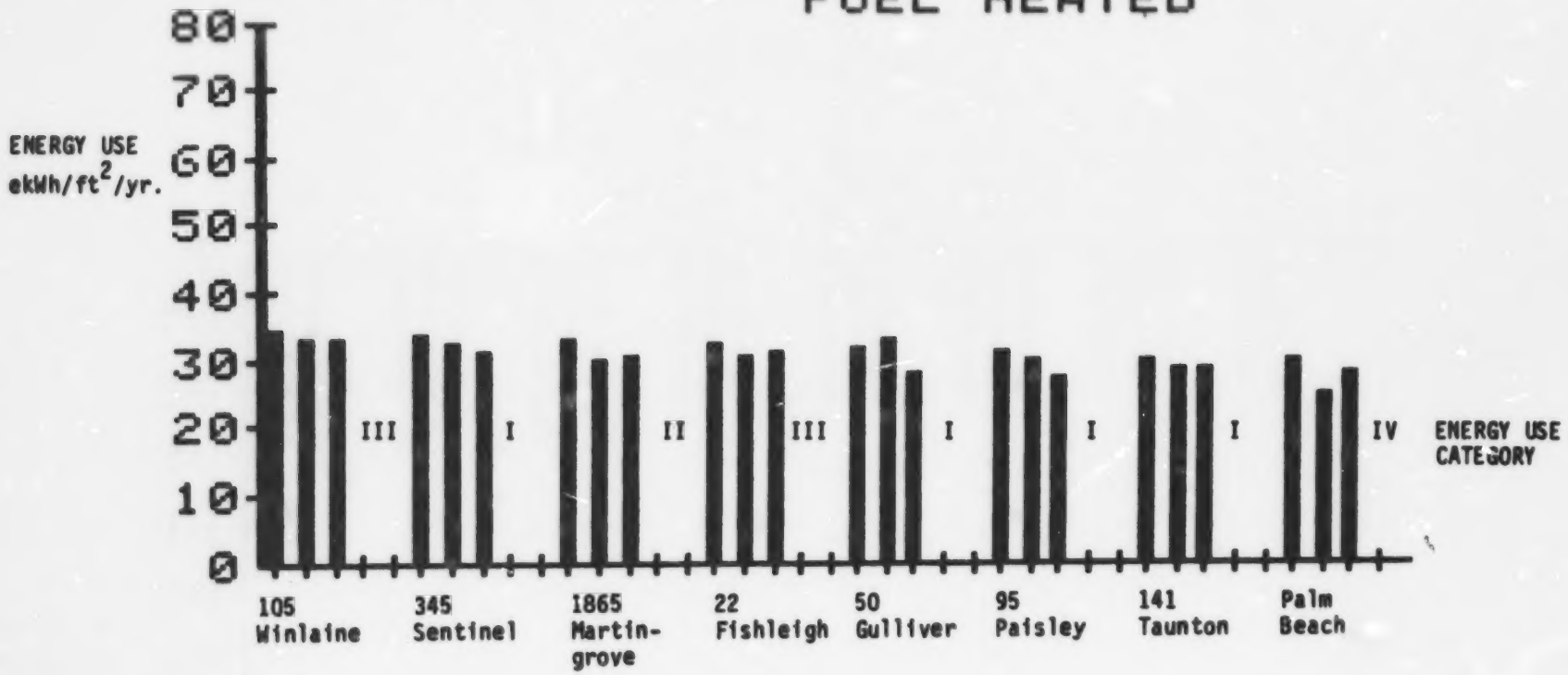


FIG 2.1C : ENERGY USE SUMMARY FUEL HEATED

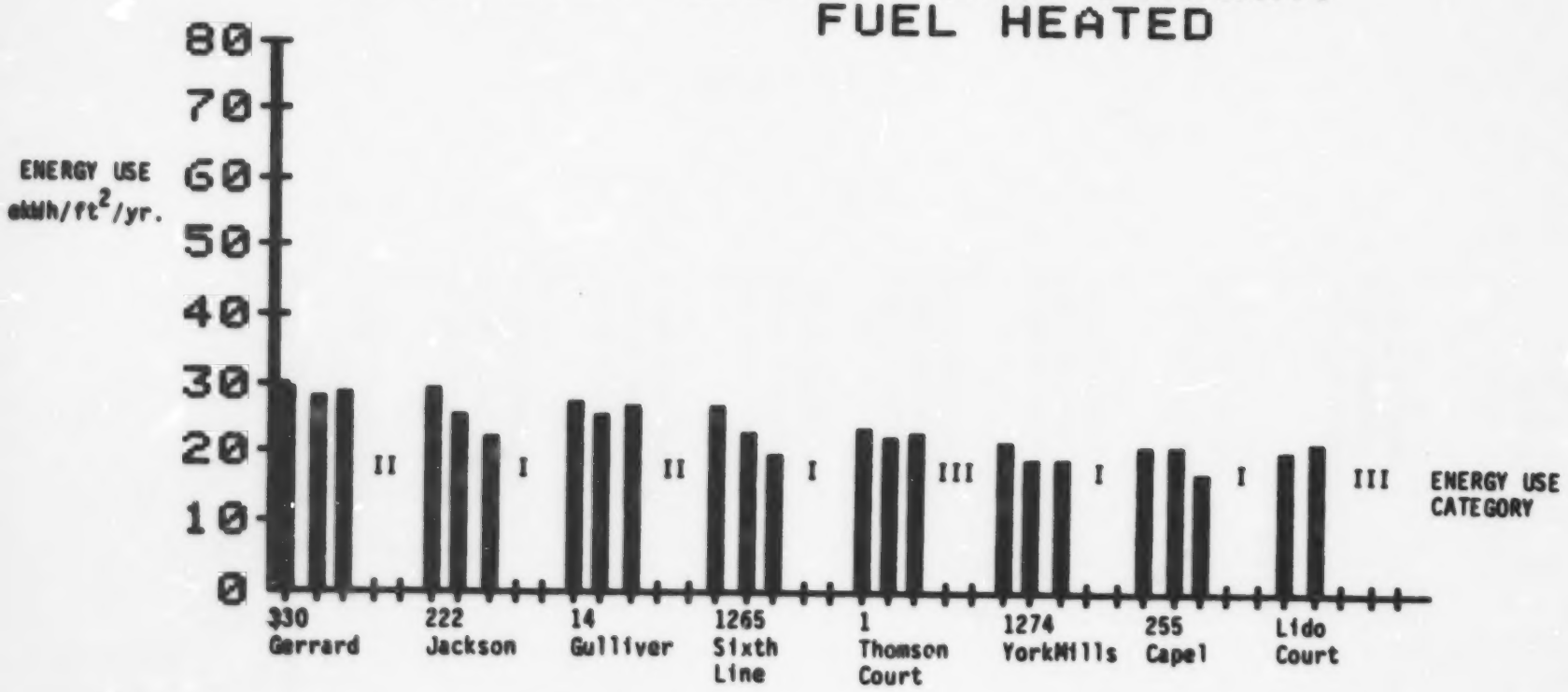
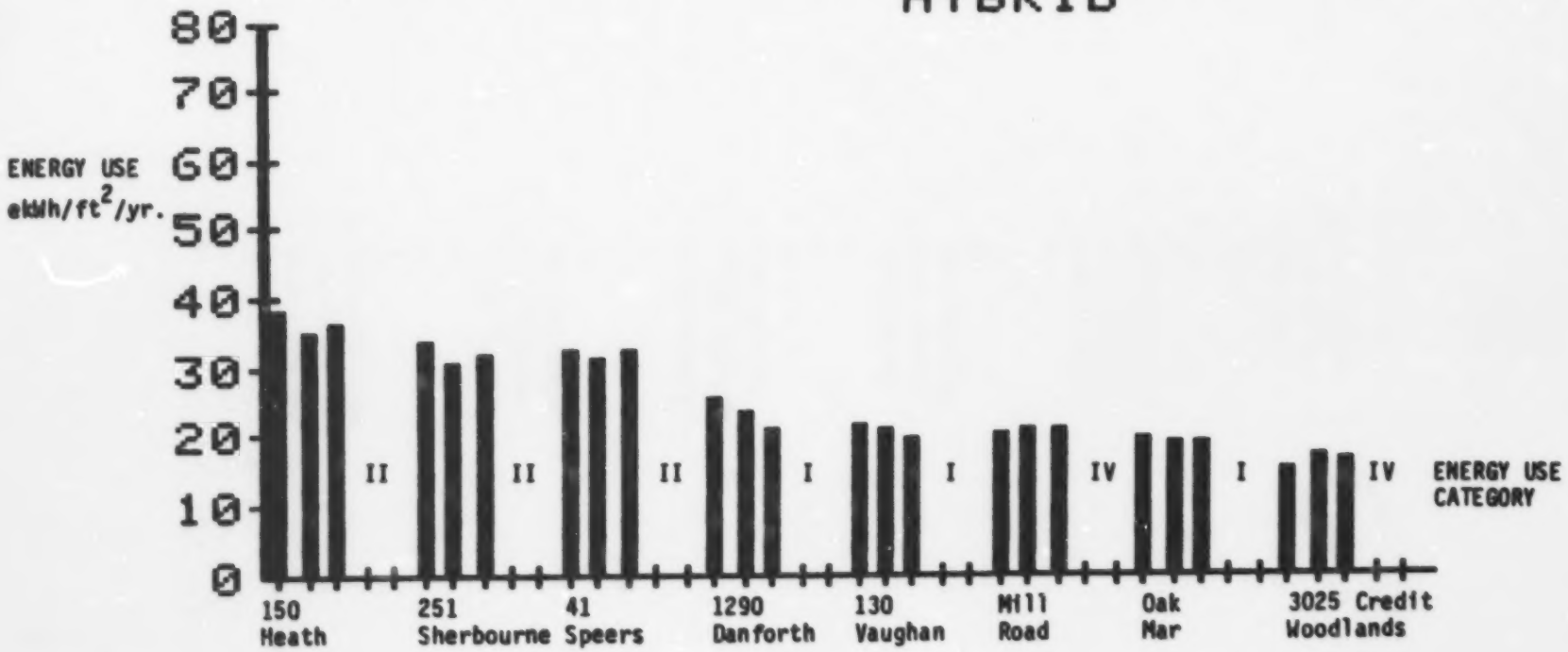
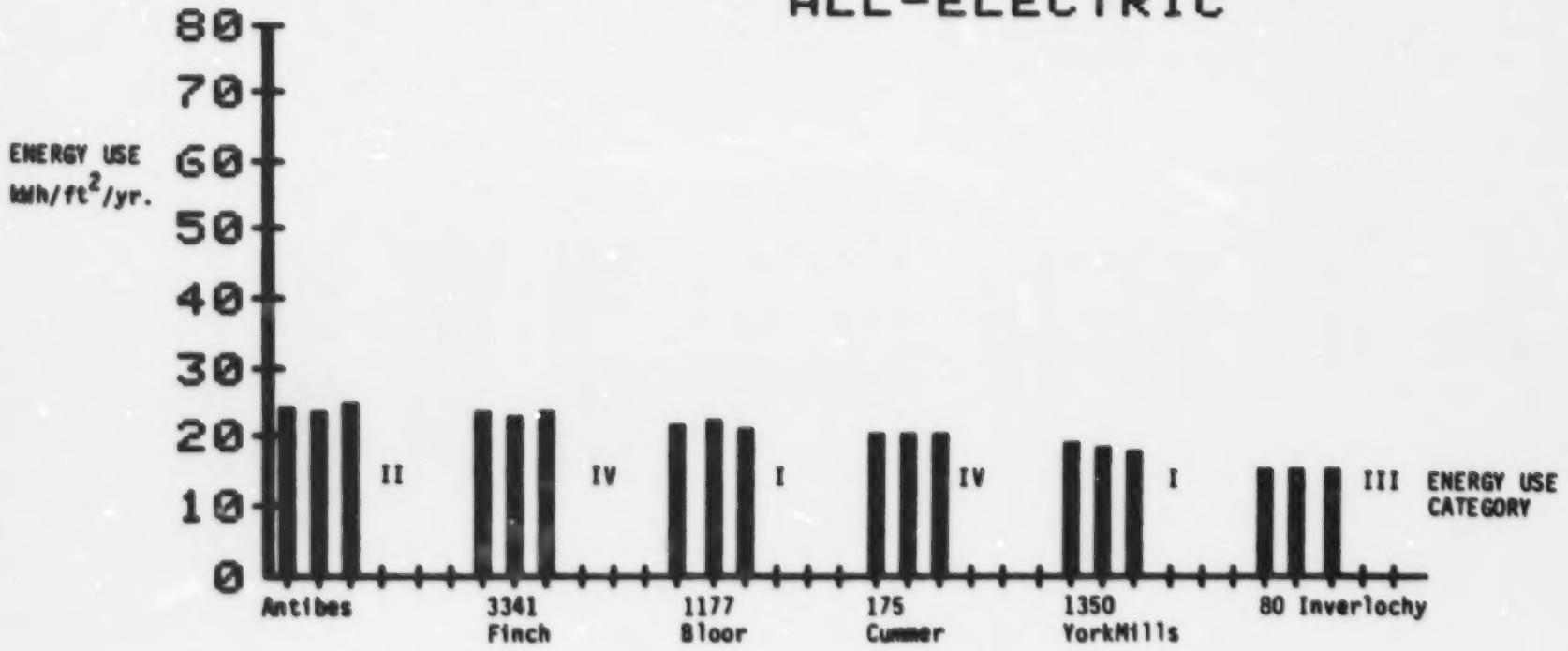


FIG 2.2 : ENERGY USE SUMMARY HYBRID



BUILDING

FIG 2.3 : ENERGY USE SUMMARY
ALL-ELECTRIC



BUILDING

3.2 Energy Performance of the Four Building Categories

Table 2.13 presents total energy use per square foot for the base year and two monitored years. The buildings are grouped in this table according to the categories identified above. The following findings are taken from Table 2.13:

- Category I (improved savings in second year)

  . Energy Use:

	ekWhr./sq.ft./year	
	Average	Range
Fuel Heated (13 buildings)		
Base Year	32.71	20.49 - 54.23
First Year	31.69	20.64 - 53.78
Second Year	28.44	16.97 - 49.63
Hybrid (3 buildings)		
Base Year	22.06	19.80 - 24.97
First Year	20.83	18.84 - 23.12
Second Year	19.59	18.78 - 20.66
All-Electric (2 buildings)		
Base Year	20.16	18.93 - 21.40
First Year	20.28	18.27 - 22.29
Second Year	19.41	17.86 - 20.96

  . Average energy savings in the second year for the eighteen buildings were 12 percent.

  . The highest percentage energy savings were at 51 Gamble which saved 29 percent in the second year after converting the central boiler from oil to gas.

  . Next were at 255 Capel and 1290 Danforth, which both achieved 17 percent savings. 255 Capel was the second lowest energy user among the twenty-four fuel heated buildings.

- Category II (reversal of results between first and second year)

. Energy Use:

	ekWhr./sq.ft./year Average	Range
Fuel Heated (4 buildings)		
Base Year	31.80	27.48 - 37.26
First Year	28.42	25.53 - 30.65
Second Year	29.40	26.46 - 32.09
Hybrid (3 buildings)		
Base Year	34.83	32.49 - 38.21
First Year	32.11	30.82 - 34.95
Second Year	33.40	32.25 - 35.98
All-Electric (1 building)		
Base Year	24.20	-
First Year	23.47	-
Second Year	24.50	-

. Average energy savings for this category were 5 percent.

. All eight buildings showed energy savings in the first year which decreased in the second year. Only Antibes, the all-electric building, showed an increase in energy use in the second year over the base year.

- Category III (no significant change)

. Energy Use

	ekWhr./sq.ft./year Average	Range
Fuel Heated (5 buildings)		
Base Year	31.83	20.17 - 49.48
First Year	31.19	21.33 - 49.47
Second Year	31.36	22.67 - 48.72

All-Electric (1 building)		
Base Year	14.91	-
First Year	15.15	-
Second Year	15.01	-

. Average energy savings were 2 percent for this category.

- Category IV (energy use changes due to factors outside project)

. Energy Use

	ekWhr./sq.ft./year	
	Average	Range
Fuel Heated (2 buildings)		
Base Year	50.56	29.57 - 71.56
First Year	37.93	24.96 - 50.90
Second Year	37.63	27.92 - 47.35
Hybrid (2 buildings)		
Base Year	17.6	14.79 - 20.40
First Year	18.75	16.95 - 20.55
Second Year	18.52	16.17 - 20.87
All-Electric (2 buildings)		
Base Year	21.80	20.14 - 23.46
First Year	21.34	19.98 - 22.71
Second Year	21.48	19.91 - 23.06

. There was an average energy use saving of 4 percent for this category.

TABLE 2.13

TOTAL ENERGY PERFORMANCES OF THE BUILDINGS FOR THE THREE YEARS (ekWhr./sq.ft./year)

	BASE YEAR 1980/1981	FIRST YEAR 1981/1982	SECOND YEAR 1982/1983
CATEGORY I			
FUEL HEATED			
255 CAPEL	20.49	20.64	16.97
1274 YORK MILLS	21.29	19.15	18.66
1265 SIXTH LINE	26.46	22.69	19.34
222 JACKSON	28.89	25.60	21.94
141 TAUNTON	30.00	28.20	28.43
95 PAISLEY	31.31	29.54	26.98
50 GULLIVER	31.43	32.76	27.78
345 SENTINEL	33.30	32.47	30.73
270 CASSANDRA	35.30	36.05	33.31
350 EAST MALL	37.05	35.34	32.82
3311 KINGSTON RD.	37.70	37.26	36.23
51 GAMBLE	37.77	38.55	26.95
1860 LAWRENCE	54.23	53.78	49.63
HYBRID			
OAK MAR	19.80	18.84	18.78
130 VAUGHAN	21.40	20.52	19.33
1290 DANFORTH	24.97	23.12	20.66
ALL-ELECTRIC			
1350 YORK MILLS	18.93	18.27	17.86
1177 BLOOR	21.40	22.29	20.96
CATEGORY II			
FUEL HEATED			
14 GULLIVER	27.48	25.53	26.46
330 GERRARD	29.32	27.95	28.70
1865 MARTINGROVE	33.15	29.57	30.36

TABLE 2.13 (contd)

	BASE YEAR 1980/1981	FIRST YEAR 1981/1982	SECOND YEAR 1982/1983
CATEGORY II (contd)			
717 EGLINTON	37.26	30.65	32.09
HYBRID			
41 SPEERS	32.49	30.82	32.25
251 SHERBOURNE	33.8	30.55	31.97
150 HEATH	38.21	34.95	35.98
ALL-ELECTRIC			
115-135 ANTIBES	24.2	23.47	24.5
CATEGORY III			
FUEL HEATED			
LIDO COURT	20.17	21.33	*
1 THOMSON COURT	23.20	22.05	22.67
22 FISHLEIGH	32.33	30.21	31.14
105 WINLAINE	33.95	32.91	32.96
206 ST. GEORGE	49.48	49.47	48.72
ALL-ELECTRIC			
80 INVERLOCHY	14.91	15.15	15.01
CATEGORY IV			
FUEL HEATED			
PALM BEACH	29.57	24.96	27.92
2163 QUEEN	71.56	50.9	47.35
HYBRID			
3025 CREDIT WOODLANDS	14.79	16.95	16.17
MILL ROAD	20.4	20.55	20.87
ALL-ELECTRIC			
175 CUMMER	20.14	19.98	19.91
3341 FINCH	23.46	22.71	23.06

*Data unavailable.

3.3 Dollar Savings of the Four Building Categories

Table 2.14 shows the first and second year dollar savings of the buildings, grouped in the four categories. Within each category, buildings are presented in descending order of second year savings. The percentage dollar savings are also given, as are factors affecting savings performance, where applicable.

The highest total dollar savings for the two years occurred at 1350 York Mills, an all-electric condominium. The success of this building is mainly attributable to the enthusiasm and dedication of the building representatives. The dollar savings for the two years can be summarized as follows:

CATEGORY	AVERAGE SAVINGS	
	$/building	Percent
I	9,820	22
II	7,625	11
III	6,840	3
IV	-1,849	12

The highest dollar savings were not necessarily achieved in the buildings with the highest initial energy use, or in the largest buildings. Several of the category I buildings, which achieved savings in the first year and improved savings in the second, had low initial total energy use. The second lowest energy user among the fuel heated buildings, 255 Capel, achieved $3,575 energy cost savings in the second year. The highest combined savings for the two years were achieved at 1350 York Mills, third lowest in initial energy use of the six all-electric buildings. One of the smallest buildings, 51 Gamble, with an area of only 47,300 sq.ft. achieved the highest second year energy cost savings, worth $22,600.

TABLE 2.14

SUMMARY OF RESULTS

(Buildings presented in order of second year savings)

BUILDING	HEATING	TOTAL DOLLAR SAVINGS FIRST YEAR $	FIRST YEAR %	SECOND YEAR $	SECOND YEAR %	COMMENTS
CATEGORY I						
51 GAMBLE		-892	-1	22,597	50	Boiler converted from oil to gas
1350 YORK MILLS	ELECTRIC	10,127	3	20,806	7	Enthusiastic condominium board
1265 SIXTH LINE	FUEL	9,331	15	17,313	24	Dedicated Manager
222 JACKSON	FUEL	5,783	9	14,968	20	3 person team attended all workshops
1860 LAWRENCE	FUEL	1,508	1	12,240	8	
1290 DANFORTH	HYBRID	2,679	4	6,511	10	
350 EAST MALL	FUEL	2,672	5	5,908	9	
345 SENTINEL	FUEL	2,574	5	5,009	9	
3311 KINGSTON RD	FUEL	1,208	1	4,694	4	
95 PAISLEY	FUEL	1,781	5	4,080	11	
1274 YORK MILLS	FUEL	2,853	10	3,842	12	
255 CAPEL	FUEL	-338	0	3,575	14	

TABLE 2.14 (contd)

BUILDING	HEATING	TOTAL DOLLAR SAVINGS FIRST YEAR $	%	SECOND YEAR $	%	COMMENTS
50 GULLIVER	FUEL	Monitor year incomplete		3,453	11	
130 VAUGHAN	HYBRID	1,810	5	2,995	8	
141 TAUNTON	FUEL	2,699	8	2,881	7	
1177 BLOOR	ELECTRIC	-7,051	-5	2,755	2	
OAK MAR	HYBRID	1,715	3	2,527	4	
270 CASSANDRA	FUEL	-155	0	2,311	4	
CATEGORY II						
150 HEATH	HYBRID	10,158	10	6,989	7	Building management change
717 EGLINTON	FUEL	5,327	15	4,582	12	
1865 MARTINGROVE	FUEL	5,213	8	3,905	6	
251 SHERBOURNE	HYBRID	6,931	5	2,011	1	
14 GULLIVER	FUEL	2,090	7	1,332	4	
330 GERRARD	FUEL	1,788	4	799	2	Limited funds available

TABLE 2.14 (contd)

BUILDING	HEATING	TOTAL DOLLAR SAVINGS FIRST YEAR $	%	SECOND YEAR $	%	COMMENTS
41 SPEERS	HYBRID	1,888	2	-963	0	Building management change
115-135 ANTIBES	ELECTRIC	10,258	4	-1,307	1	
CATEGORY III						
80 INVERLOCHY	ELECTRIC	-10.8	0	1,850	2	
206 ST.GEORGE	FUEL	532	1	929	2	
1 THOMSON CT.	FUEL	258	1	718	1	
105 WINLAINE	FUEL	753	3	590	2	Limited funds available
22 FISHLEIGH	FUEL	1,006	4	350	1	No action taken
LIDO COURT	FUEL	-135	0	Data unavailable		No action taken
CATEGORY IV						
PALM BEACH	FUEL	11,781	19	6,687	10	Building under renovation
2163 QUEEN	FUEL	5,387	26	6,452	29	Building under renovation

TABLE 2.14 (contd)

TOTAL DOLLAR SAVINGS

BUILDING	HEATING	FIRST YEAR $	FIRST YEAR %	SECOND YEAR $	SECOND YEAR %	COMMENTS
3341 FINCH	ELECTRIC	3,643	3	4,488	3	Demand control equipment installed by Ontario Hydro, caulked entire bldg.
175 CUMMER	ELECTRIC	3,987	4	-1,673	-1	Non-functional bldg. equipt. brought back into service
MILL ROAD	HYBRID	-9,844	-1	-8,342	-1	Occupancy increase
3025 CREDIT WOODLANDS	HYBRID	-21,175	-12	-12,484	-6	Occupancy increase

3.4 Actions Taken and Expenditures Made

Expenditures made on changes to building systems are shown in Table 2.15. Most did some work on the ventilation systems, although the largest overall expenditure was on lighting conversions. A few buildings invested more than the $5,000 limit set for the project. These were 51 Gamble, 1350 York Mills, 3311 Kingston Road, 222 Jackson, 175 Cummer and Mill Road. With the exception of 175 Cummer and Mill Road, both Category IV buildings, expenditures paid back approximately within the two years of the project. The average expenditures for each category are given below:

	AVERAGE EXPENDITURE
CATEGORY	$/building
I	3,993
II	581
III	1,050
IV	3,715

The poor performance categories, II and III, spent less, on the average, on energy management actions. Of the category I buildings, the largest expenditure was at 1350 York Mills. The $23,000 spent primarily on outside lighting and enclosing the heated ramp, paid back in just over one year. The lowest cost was at 1274 York Mills which reported no expenditures during the program, but achieved $3,840 savings in the second year from no cost actions such as delamping.

For the most part, actions taken were low cost operational changes with short paybacks. The average payback for actions taken by category I buildings was half a year, based on second year savings.

TABLE 2.15

SUMMARY OF COSTS INCURRED DURING PROGRAM

COST $

	LIGHTING	VENTILATION	RAMP HEATER & GARAGE	BOILERS, HEATING & DHW SYSTEMS	TOTAL
CATEGORY I					
51 GAMBLE	0	0	0	10,000	10,000
1350 YORK MILLS	8,000	1,000	14,000	0	23,000
1265 SIXTH LINE	3,600	300	0	0	3,900
222 JACKSON	0	3,000	0	3,000	6,000
1860 LAWRENCE	200	1,530	0	0	1,730
1290 DANFORTH	0	600	0	300	900
350 EAST MALL	0	0	0	3,720	3,720
345 SENTINEL	2,000	600	0	100	2,700
3311 KINGSTON RD	4,700	50	0	2,830	7,580
95 PAISLEY	0	180	0	1,250	11,430
1274 YORK MILLS	0	0	0	0	0
255 CAPEL	0	300	0	0	300
50 GULLIVER	0	200	1,600	300	2,100
130 VAUGHAN	200	500	0	0	700
141 TAUNTON	0	800	150	0	950
1177 BLOOR	0	550	0	0	550
OAK MAR	3,000	1,500	0	400	4,900
270 CASSANDRA	0	0	580	800	1,380
CATEGORY II					
150 HEATH	0	1,380	0	0	1,380
717 EGLINTON	200	340	0	600	1,140
1865 MARTINGROVE	0	200	0	70	270
251 SHERBOURNE	0	300	0	0	300
14 GULLIVER	300	600	0	0	900
330 GERRARD	0	360	0	0	360
41 SPEERS	0	300	0	0	300
115-135 ANTIBES	0	0	0	0	0

TABLE 2.15 (contd)

	LIGHTING	VENTILATION	RAMP HEATER & GARAGE	BOILERS, HEATING & DHW SYSTEMS	TOTAL
CATEGORY III					
80 INVERLOCHY	0	225	0	0	225
206 ST.GEORGE	1,800	150	0	75	2,025
1 THOMSON CT.	0	0	0	300	300
105 WINLAINE	0	600	0	4,200	4,800
22 FISHLEIGH	0	0	0	0	0
LIDO COURT	0	0	0	0	0
CATEGORY IV					
PALM BEACH	0	0	0	0	0
2163 QUEEN	0	0	0	0	0
3341 FINCH	850	350	0	0	1,200
175 CUMMER	600	1,500	0	3,300	5,400
MILL ROAD	6,000	6,000	0	3,000	15,000
3025 CREDIT WOODLANDS	0	700	0	0	700
TOTAL	31,450	24,115	16,330	34,245	96,140

3.5 Summary of Factors Affecting Results Achieved

Throughout this report, relationships have been suggested between various factors and the savings achieved. These factors are:

- heating system type
- ownership type
- workshop attendance
- base year energy use

The influence of these factors on the savings made in each category are summarized together below:

Category I

- eighteen buildings
- heating system type: 13 fuel heated
  3 hybrid
  2 all-electric
- ownership type: 14 rental
  2 co-ops
  1 condominiums
  1 non-profit
- workshop attendance: average = 6.5 workshops
- base year energy use: average ekWhr./sq.ft./year

Fuel heated	32.71
Hybrid	22.06
All-Electric	20.16
Average	29.05

- average building size: 136,400 sq.ft./building
- average expenditure: $3,993/building
- average savings: $9,820/building

Category II

- eight buildings
- heating system type: 4 fuel heated
  3 hybrid
  1 all-electric
- ownership type: 4 rental
  0 co-ops
  2 condominiums
  2 non-profit
- workshop attendance: average = 6.0 workshops
- base year energy use: average ekWhr./sq.ft./year

Fuel heated	31.80
Hybrid	34.3
All-Electric	24.20
Average	31.79

- average building size: 130,510 sq.ft./building
- average expenditure: $581/building
- average savings: $7,625/building

- Category III

- six buildings: 5 fuel heated
  0 hybrid
  1 all-electric
- ownership type 4 rental
  1 co-op
  1 condominium
  0 non-profit
- workshop attendance: average = 6.0 workshop
- base year energy use: average ekWhr./sq.ft./year

Fuel heated	31.83
All-Electric	14.91
Average	29.01

- average building size: 78,630 sq.ft./building
- average expenditure: $1,050/building
- average savings: $6,840/building

- Category IV
  - six buildings: 2 fuel heated
    2 hybrid
    2 all-electric
  - ownership types: 1 rental
    1 co-op
    2 condominium
    2 non-profit
  - workshop attendance: average = 5.2 workshops
  - base year energy use: average ekWhr./sq.ft./year

Fuel heated	50.56
Hybrid	17.60
All-electric	21.80
Average	31.10

  - average building size: 126,400 sq.ft./building
  - average expenditure: $3,715/building
  - average savings: $-1,849/building

3.6 Conclusions Regarding Workshop Program

The outcome of the project produced a number of conclusions regarding necessary ingredients for success in a workshop program:

- Continuity - as learned in an earlier project, the program can be affected by changes in building representation, since newcomers usually find it difficult to make up lost ground. In this project, having more than one representative for several of the buildings contributed to its success.
- Commitment - the program requires commitment by the Board or the Owner of time and expenditure to make necessary changes. If such commitment is not forthcoming from the outset, progress is slow and the building representative - usually the property manager or superintendent - frequently loses heart.
- Building Inspection - the consultant should witness first hand the specific problems and opportunities in each building. This will lead to better direction in the workshops, and less time from building representatives retrieving information.

In addition to covering formal agenda for the workshops, a number of issues were raised which affect energy management in apartment buildings:

1. Lack of Incentive

   Increases in utility costs can be recovered by the landlord of a rental building through the rent review process. Conversely, savings that he may achieve can result in lower rent increases. Owners and managers of rental buildings frequently mentioned the disincentive to energy conservation caused by the existing rent review legislation.

   Operating cost deficits are publicly funded in non-profit and public housing projects. These were also identified as having less incentive to conserve energy than in

condominiums where suite owners pay utility bills or for co-operative projects where the cost of energy is shared among the tenants.

2. Lack of knowledge

Participants expressed strong appreciation of the Ministries involved in making energy management training available to the industry through this project. It was felt that similar training should be available for property managers and superintendents on an ongoing basis. The majority of owners and managers would be prepared to pay for their staff to attend good training courses.

3. Lack of Money

It is apparent from this and from the earlier project that energy management provides a very good return on investment. Despite the original commitment to implement necessary changes, at least one of the rental buildings was obliged to delay expenditures because of cash flow problems. All the other buildings were able to pay the generally minor costs involved. It was felt that energy management case studies should be documented for financial managers, who would become a driving force for energy conservation once they appreciated the potential.

POOR

QUALITY

ORIGINAL